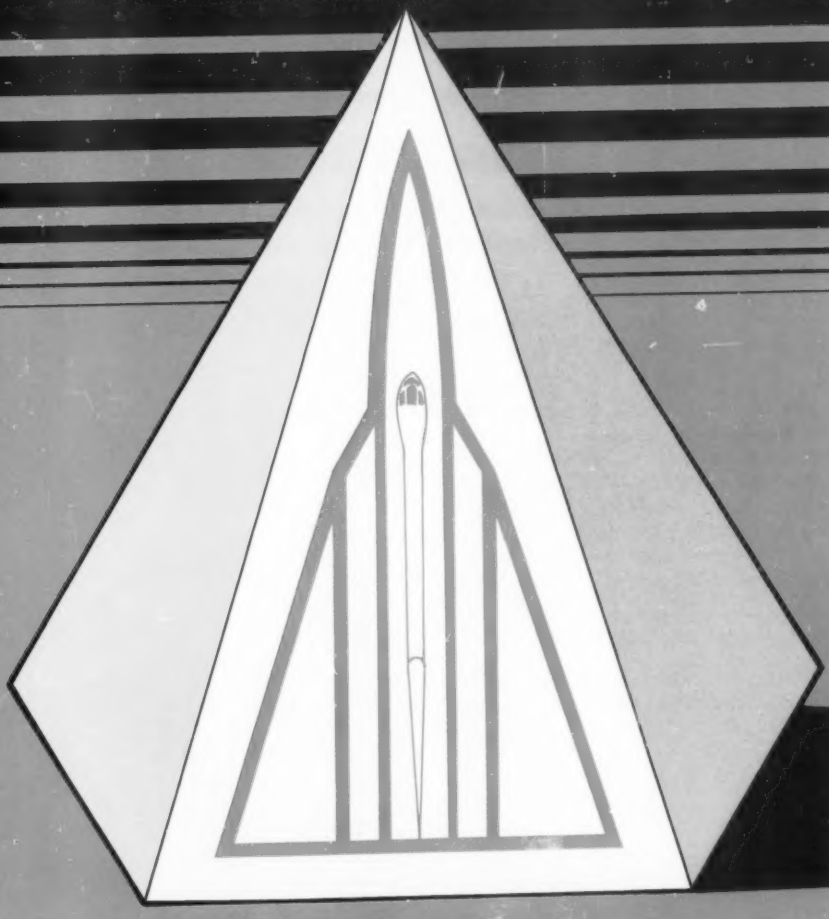
AIR UNIVERSITY review

NOVEMBER-DECEMBER 1980



the independent variable

The nature of war has changed enormously over the centuries. Advancing technology has accounted for much of that change. Few would debate either of these statements. The historical record is clear: from the stirrup and crossbow through gunpowder, to the internal combustion engine, radar, miniaturized electronics, and precision-guided munitions, the nation that is slow to exploit new technology fights at a severe and often fatal disadvantage.

But what are the consequences of the process of advancing technology? More important, how do we form our ideas of what they might be? The usual predictive construct involves a two-dimensional graph with time plotted along the horizontal axis and destructive capability on the vertical. The curve of destructiveness begins low on the left-hand margin with cavemen bashing each other's heads in with rocks. It traverses the Neolithic era nearly parallel with the lower margin, tracing the cumulative effect of sharp sticks and flint knives, assumes a gentle upward tilt in late prehistory with metal weapons and the bow, steepens modestly with the arrival of gunpowder in the early 1200s, and then curves exponentially upward with the appearance of railroads and steamships, high explosives, mass production, the machine gun, tanks, and aircraft. The curve ends arcing straight up past nuclear weapons to implied obliteration.

Political and policy conclusions flow all too easily from the obvious visual suggestion. Technology has become so destructive as to be irrelevant—or so the graph suggests. Some analysts question the implications of the construct, pointing out that as the destructiveness of weapons has increased, combatant casualties, at least, have generally declined.

History suggests that the problem is not one of faulty interpretation but of an inappropriate frame of reference, that we may have been using the wrong independent variable. Total casualties and destruction, like combatant casualties, show no clear trend as functions of time *or* technology. The devastation inflicted on Carthage by Rome finds no real modern parallel except perhaps in Hitler's "Final Solution" for European Jewry and the self-inflicted destruction of Cambodia—both largely brought about with relatively unsophisticated weaponry. The record suggests, then, that neither time nor the absolute level of military technology is the critical variable. Instead, cultural differences, incompatibility of life-styles and their economic underpinnings, and depth of enmity seem far more closely linked to death and destruction than either time or technology.

Success or failure in militarily exploiting advances in technology undoubtedly constitutes a large part of the difference between victory and defeat. But the development of technologically advanced weapon systems does not necessarily make war any bloodier or more destructive.

The complexities and horrors of war do not lend themselves to conceptualization in linear two-dimensional form. If time is not the independent variable, as we have argued here, then we need to change our mental construct.

J. F. G.

For the basic mathematical principles underlying this analysis, I am indebted to Lt. Col. John T. McGrath, Department of Physics, USAF Academy.

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A SPACE POLICY FOR THE 1980s— AND BEYOND

THE HONORABLE CECIL HEFTEL
Member, U.S. House of Representatives

THE tendency to think of military service as a profession devoted exclusively to activities related to war is a recent phenomenon in American history that has isolated the military from its deepest tradition, which is not war.

Earlier generations tapped that tradition frequently and with memorable results. When President Thomas Jefferson organized a continent-spanning expedition to explore America's natural resources, his choice for the command role fell naturally on two U.S. Army captains. The team of scientists selected for that expedition unhesitatingly welcomed the leadership of Captains Meriwether Lewis and William Clark. A generation later, when America's horizons were expanding beyond the continent into blue water, U.S. Navy Lieutenant Charles Wilkes commanded a squadron of six ships, with a large complement of trained scientists, on an exploring expedition lasting three years and reaching from the Antarctic Ocean through Fiji, Tahiti, Hawaii, to the Pacific Northwest. Lieutenant Wilkes subsequently edited the scientific reports of the expedition, 20 volumes and 11 atlases.

By providing organization, protection, and leadership for scientific expeditions into remote regions, Lewis, Clark, Wilkes, and many other intrepid American military commanders were continuing a tradition as old as civilization, pursued by the Greeks in Asia Minor, the Romans in Gaul and Britain, the French in Egypt, including the awesome navigational undertakings of the Norsemen in the Atlantic and Polynesians in the Pacific, as well as such military-directed expeditions as the voyage on which Charles Darwin gathered material leading directly to his theory of evolution.

Indeed, the heroic virtues that enjoy the highest place of honor among the military services were originally shaped in an age predating human conflict, when emergent human consciousness stood before a vast, in-

comprehensible, darkly threatening primordial world and struggled to overcome its fears in order to extend the boundaries of its perception and understanding. As horror movies continually remind us, nothing is more terrifying to the human animal than the dark unknown. It was to overcome those terrors that what have become known as military virtues and disciplines were developed and eventually institutionalized, so to shape the characters of such leaders as U.S. Navy Lieutenant Wilkes and Army Captains Lewis and Clark.

As a consequence, military personnel were far more integrated into society than they are now. Their role was more diversified; they enjoyed greater respect from a broader spectrum of the population. But in recent years, there has evolved in our nation a military establishment that is at once the most powerful in history and the most narrowly conceived.

The youngest of the United States military services, the Air Force, was captured by that narrowing process almost at its inception in 1947, which coincided with the birth of the Cold War. It was also a time when humanity's attention was turning upward toward a new frontier accessible only to airborne explorers. On 4 October 1957 the Soviet Union launched *Sputnik* I. Suddenly, it seemed as if our position as the world's leader in science and technology was collapsing. Executive task forces were convened, Congress launched inquiries, the mass media delivered an avalanche of soul-searching commentaries. Public outcry reached a fever pitch when the Soviets launched another satellite in November, this one weighing 500 kilograms and with a dog aboard. To make matters worse, our first attempt, on 6 December, ended in failure. The already frantic decision-making tempo accelerated. In February, shortly after we finally managed to send *Explorer* I into orbit, the Secretary of Defense came up with a plan to integrate all existing manned space flight projects under the Air Force. But President Eisenhower hesitated. Hearings being conducted by Senate Majority Leader Lyndon Johnson showed a strong sentiment, endorsed by Johnson, to avoid projecting Cold War tensions into deep space. Defense should not be banned from space, it was concluded, but the space effort should be centered around a civilian agency.

A National Aeronautics and Space Act was hurriedly drawn up. It passed the Congress in July; and on 1 October 1958, just one frenzied year after the Soviets launched *Sputnik* I, NASA formally came into being. Among its first presidentially approved actions was the absorption of a number of military space exploration programs, including those directed by the famous Army rocketry team at Huntsville, Alabama, under Wernher von Braun, plus the von Braun team itself, as well as the facilities and many of the key personnel at the sprawling Jet Propulsion Laboratory at Pasadena, California. Later, an Air Force-manned orbiting laboratory project was abandoned in favor of a NASA effort.

But the Air Force, and to a lesser extent the other armed services, continued to play a considerable role in our space program. The rockets boosting American astronauts into orbit were so-called man-rated versions of intercontinental ballistic missiles developed by the Air Force and launched from sites built by the U.S. Army Corps of Engineers. Air Force-operated missile ranges and their associated tracking stations formed the core of that side of the program. And the Navy deployed entire fleets of ships to aid in recovery after splashdown.

For the NASA biosatellite series, the Air Force operated an airborne recovery system, provided airborne terminal tracking of reentering capsules, made available space at Hawaii's Hickam AFB for a NASA receiving lab, and delivered the recovered capsules there.

But it was during our space program's most ambitious effort, the Apollo lunar project and its preparatory Gemini phase, that the Air Force contribution reached its peak. Early in the program, a critical need developed for qualified personnel to fill key positions in management and systems integration. In response, 42 top-rated Air Force officers, ranging from major to brigadier general, were detailed to NASA. Subsequently, serious personnel deficiences appeared in the mission control division. Again, the Air Force filled the gap: 128 Air Force officers were detailed to the manned space center at Houston—6 majors, 38 captains, and 84 lieutenants. I doubt that more than a tiny fraction of the millions of television viewers who followed the drama at its peak realized how many of the men in civilian clothes operating those futuristic consoles at mission control were members of the United States Air Force. Nor did they know that Apollo's elaborate lunar mapping program would have foundered without Air Force assistance. Or that the Apollo program director during its critical phase, and probably the one person most responsible for its success, was Air Force Lieutenant General Samuel C. Phillips, who was also detailed to NASA. There can be no doubt that without the active participation of the Air Force, Apollo would not have gotten off the ground.[1]

And I have yet to mention the astronauts. Of the first 73 astronauts selected, 17 were scientist-astronauts, the remainder were pilots. Every one of those 55 pilots was either a military pilot or a former military pilot, and you could count those belonging to the latter category on the fingers of one hand. The group of 35 astronaut candidates selected in 1978 for the space shuttle program includes 15 pilots, 14 of them military personnel. Needless to say, the Air Force has accounted for the majority of our pilot astronauts.

Yet, despite the overwhelming preponderance of military pilots in the space program, the first man to step on the moon was a civilian, and the commander of the first space shuttle orbital flight scheduled for later this year will be a civilian—both, of course, have had military flying experience.

With involvement in the space program either denied or degraded for the sake of a "peaceful" image, the military services are left with no option but to seek to justify and amplify their wholly natural interest in space solely in terms of the Cold War. Naturally, they have done so. And although initially left at the post, they are proving more effective at acquiring funds for space projects than NASA. The Department of Defense space budget is now roughly equivalent to NASA's, and it is growing at a faster rate in tandem with increasing talk of a space arms race. So we see occurring exactly what NASA was created to prevent.

Defense space budget notwithstanding, the current schizophrenic state of our space affairs is not doing the military any good, especially those personnel belonging to the youngest and what should be the most restlessly visionary branch of service, in the best sense. I will come back to this point.

The manned aircraft is the heart of the Air Force, and right now that heart is losing blood. Pilots are leaving the Air Force in record numbers. The 1978 rate was 40 percent after the required six years of active duty, up 14 percent over 1977.

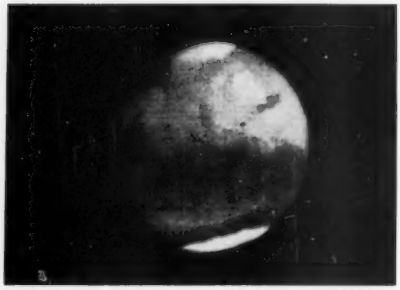
By way of explanation, statistics are being cited showing the comparative monetary attractiveness and stability of commercial aviation and its growing need for trained pilots. But a recent Air Force study also shows that of 179 pilots separating, 74 percent did not have a projected civilian job. So it is not just a promise of money and stability that is causing the drain.

Recently, a newsmagazine quoted an excerpt from a letter written by an anonymous pilot. "Dear Boss," the letter began, "I've been to the mountain and looked and I've

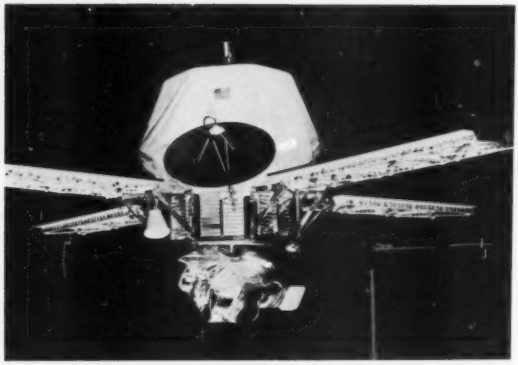
Continued on page 10

a photographic Martian chronicle

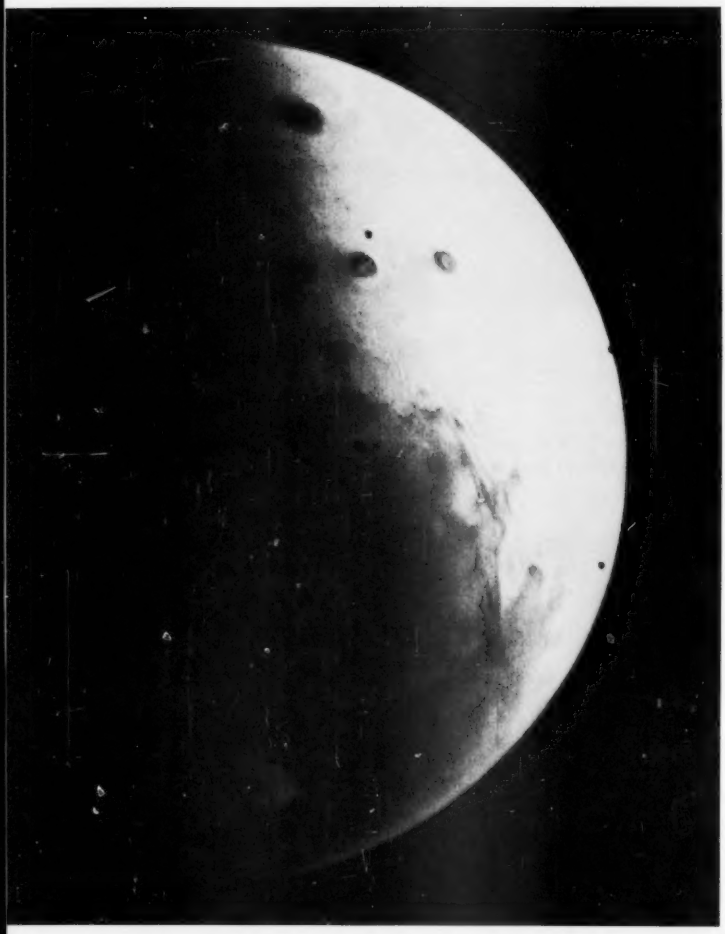
NASA's Martian connection began early in the space age. Since that time, despite periods of austerity and relative apathy, our program of space exploration has assisted scientists in their quest to gain as much knowledge of the Red Planet as possible. The accompanying photographs reflect the results of their endeavors.



The photograph (left) taken by Mariner 7 indicates sharply defined features of the Red Planet. The dark linear area to the right is the Cerberus canal. The bright ring at upper right appears to be a crater at least 200 miles in diameter and is located in the area known as Elysium. It is now spring in the southern hemisphere, distinguishable by the cap border slowly shrinking in size, revealing more of the Mare Australe region each day. . . . All four craters shown here (below) reveal frost accumulation, indicated by the white shading in the crater centers. The three largest craters are located at the edge of rough terrain and the largest crater exhibits a scalloped edge which could have resulted from mechanical erosion.



A decade after NASA's Martian activities commenced, exploration efforts continued; the Mariner 9 spacecraft (above, with thermal blanket covering the retro engine) was launched 30 May 1971 and entered orbit around Mars just under six months later, on 13 November. The Mariner 9, the first man-made object to orbit another planet, was fully attitude-stabilized, using the Sun and the Star Canopus as the basic attitude references. . . . Mariner 9 photographed the moons of Mars (below), mapped 100 percent of the planet, and returned data proving that Mars was geologically alive.



Mars missions of the Viking Landers and Orbiters (top, the four largest Martian volcanoes, photographed by Viking 1 Orbiter on 17 June 1976 from a range of 350,000 miles) were to make detailed scientific measurements of the Martian surface and search for indications of life. Viking scientists have studied areas in Mexico and California with terrain superficially similar to that in this spectacular 1976 picture of the Martian landscape by the Viking 1 Lander. The dune field shows features remarkably similar to many seen in the deserts of Earth.

The photo at right depicts a portion of the surface of Mars. Taken by Viking Orbiter 1 (right) during the Survey I mission, it shows a small channel system demonstrating flow features along its length and tributaries that join the main channel, clear evidence of water erosion. . . . The Viking Lander 1 photo below, sharpened by an image-processing technique called interpolation, shows a range of drifts some 50 feet from the camera. Small horizontal markings on some of the drifts indicate that the dust was deposited there some time ago and is currently being eroded away.

seen the big picture—and it wasn't the Air Force."

There, stretching before him, the biggest and most challenging picture conceivable to the human mind, encompassing the heavens themselves—and this young pilot did not even associate it with the Air Force.

Not being a psychologist, I cannot say with any authority whether the younger generation is losing its sense of adventure. But it does not take a psychologist to conclude that the Air Force is. I would suggest that the explanation lies in strategic developments and an accompanying mentality fostered by the Cold War.

While it is true that the manned aircraft continues to be honored as the heart of the Air Force, it is equally true that, as a result of Cold War pressures, Air Force strategy is becoming increasingly heartless. It is no longer keyed to the manned aircraft but to an unmanned doomsday machine, the ICBM. As a result, those toward whom the Air Force must turn in extremis are not soaring pilots but technicians buried deep in the earth. The Air Force is going underground, literally.

We need to appreciate the colossal irony of that evolution. In the new context it creates, pay increases for pilots are as much compensation for a loss of spirit as they are for a loss of comparative earning capacity—and as such, they are doomed to perpetual failure. Pilots can only wind up earning more and more as they matter less and less. No amount of strident morale-building rationalization can change that. The heart has reasons that reason can never know. And at the heart of the Air Force is the longing to *fly,* higher and ever higher, to chart the stars. It is one of humanity's oldest and noblest impulses. The Air Force should not be charged with burying it. Yet such is the outcome of the process that captured our youngest service, so rapidly and so thoroughly that those swept up in it are scarcely aware that they are recoiling upon themselves.

What nurturance can a youthful spirit who longs to soar beyond the horizon, so to join the proud ranks of earlier generations of terrestrial and oceanic explorers in keeping humanity's deep and restless questing impulse alive, the very heartbeat of human evolution—what nurturance can such a spirit obtain from sitting underground encased in concrete, calculating catastrophic levels of destruction performed by unmanned missiles?

Agreed, ICBMs are a reality we must live with. Agreed, it is also our duty to ensure that our strategic deterrent is second to none. But unless the Air Force mission can somehow reach *beyond* the strategic deterrent, unless the Air Force can perceive of itself as some day unleashing the optimum fruits of its labors *without* destroying the world, then it, and the other armed services as well, may be doomed to increasing isolation, self-denying self-absorption, and narrowness of vision over a narrowing field of action. I present that not as a criticism but as a challenge. And I would like to offer a few specific interlocking suggestions for meeting that challenge.

1. *There should be a renewed commitment at the executive level and in Congress to an expanded space program.*

Technological leadership belongs to those who keep probing at technology's frontier. The one area where we hold undisputed technological leadership is precisely at that frontier, in space technology. But we seem unwilling to exploit it wholeheartedly.

Anyone familiar with the history of social change should find nothing surprising about American heavy industry (steel, autos) losing the competitive edge it once held. But if high technology is to pick up the slack and eventually usher in a new era of innovation, productivity, and democratizing social change, we need a working environment that will allow high technology—force it—to discover its full potential.

In a word, we need space. Already space

scientists working with the bare idea of settlements "out there" have introduced new dimensions to the study of energy production and conservation, mining and refining, recycling biological and industrial wastes, etc. And they are still at the drawing board.

Meanwhile, more and more government initiatives in the social and economic spheres suggest a ritual propping up a spent idea. We "bail out" the poor, we "bail out" giant corporations. Productivity declines, unemployment climbs, the dollar deteriorates, inflation and recession fuse and accelerate, debt loses all restraining significance and thus all meaning, yet still we steadfastly refuse to look *up*. There, overhead, the silent skies open onto an infinity, beckoning.

An escape? Was our first definably human ancestor who rose *up* on two legs, so to discover a new horizon and a new outlook and begin a new quest into an unknown new world—was that ancestor "escaping" from the problems of the age? Would it have been better if our forebears had remained around some primeval campfire, getting the old collective act together, curing disease, famine, and all the rest of it, *before* striking out? Who are we trying to kid? Even *they* knew better.

When solutions only perpetuate the problem, it is time to reopen the quest. Then we can once again draw on those marvelous by-products of the inquisitive intellect, working with unexpected possibilities opened to it by an encounter with a new world.

Unrealistic? To those enmeshed in the complexities of the "real world," it is bound to seem so at first—as it always has, in every age. Perhaps it would be helpful to remember that we go about our affairs in a "real world" that was created by previous generations of industrious emigrants who set off from another "real world" in pursuit of a dream.

2. *The heart of our space program should be manned space flight, and the Air Force should be accorded primary responsibility in that area.*

To that end, all astronaut training facilities should be transferred to Air Force supervision. Pilots, mission specialists, and scientist-astronauts should continue to be drawn from all the armed services and the civilian community. As our space missions become more daring and complex, however, greater emphasis needs to be placed on cultivating the attributes of command. It is only logical that *one* of the military services—whose academies are unique in offering courses in command operations, in the disciplines and virtues of leadership under life-threatening conditions—should receive the command assignment.

In order to fulfill that weighty responsibility, the Air Force educational establishment should be restructured. Air Force Academy undergraduates should be offered a wider variety of space-related courses, from astrophysics to the *future* history of space development. In addition, a space academy should be established, in association with the Air Force Academy and/or Air University, for astronaut training and advanced space studies, with a faculty that might include a number of former pilot and scientist-astronauts and support personnel. Air Force pilots completing their six-year active duty obligation and other space support personnel might be offered the option of postgraduate work at the space academy, on committing themselves to a subsequent tour with the Air Force space program—say an additional six years. The number of Air Force personnel admitted into the space program would, of course, be directly dependent on the scope of that program, which, in turn, would depend on the nation's commitment to an active role in space.

Although the Air Force would assume primary operational responsibility for space flight activities, NASA would not be downgraded by any means. Our mistake regarding NASA—a mistake traceable to unavoidable circumstance rather than to ig-

norance or ill-will from any quarter—was to saddle it with a heavy operational role. That role forced the agency into a charade in which it had to present a public image of operational independence while in fact relying on the Department of Defense. As a result, unnecessary tensions were generated, time was wasted in absurd negotiations over who pays for what, there was costly duplication all across the board, and the Air Force was placed in the cruel and self-denying position of being able to justify its wholly natural interest in space only in terms of a Soviet threat.

Reality and common sense will be restored when NASA is assigned a lead role in advanced research and development at two extremes of the space spectrum. On the one hand, NASA scientists would approach space as an open-ended challenge. They would conceptualize and design everything from orbiting telescopes to orbiting cities, always with a view toward reaching beyond immediate operational requirements and opening new prospects for those advancing on the frontier. On the other hand, after selected NASA concepts were transferred to the operational stage under the Air Force, NASA would seek out and develop spin-off applications for government and the private sector. (Thus, NASA's outward-bound mission would be primarily conceptual and that of the Air Force primarily operational, with the overlap necessary to integrate the two missions toward a common objective.) The support accorded NASA would then be clearly linked to the nation's commitment to maintaining preeminence in science and technology in space and here on earth; it would be the bellwether of that commitment.

3. *The Air Force should lend its influence, and, more important, its ingenuity and expertise, to the efforts now under way to reach an agreement halting the trend toward an arms race in outer space.* That means banning antisatellite weaponry and other such activities, from the relatively primitive devices currently being tested by the Soviets and under crash development on our side to advanced technologies involving lasers and particle beams and including the possible employment of the space shuttle for kidnapping Soviet satellites and/or destroying them by means of laser weapons mounted aboard.

An extension of the arms race into space is, from the perspective of the Air Force's mission potential, shortsighted to the extreme.

First, it would stall the implementation of an Air Force space program such as I have just outlined, perhaps irrevocably.

Second, it would drastically reduce the number of Air Force personnel who might become involved in space flight activities.

Instead, we would see an expanded primary role accorded a new generation of unmanned strategic weapons, an extension of a trend that is in large part responsible for declining interest in the Air Force as a career. Satellites and related ground stations would simply replace silos; remote-controlled lasers and particle beams would replace ICBMs. And when the dust cleared, we would be back on the brink, with the same fears, the same uncertainties, still greater depersonalization of the Air Force mission, and an even wider range of probabilities for a global holocaust.

(The chances for a "Star Wars" combat mission, involving competing U.S.-Soviet fleets of armed spaceships, eventually developing within the context of the Cold War are virtually nil. Each advance in technology would be tantamount to an escalation of confrontational tension and firepower. The eruption would undoubtedly occur before the "Star Wars" stage was attained. "Star Wars" mission is only conceivable vis-à-vis some extraterrestrial threat. But for that contingency to take on any meaning at all, some easing of terrestrial tension is required so that we can actually develop space fleets and get them up there. See point "4.")

On the first lap of its long journey toward space, on 18 February 1977, the space lab taxied piggyback for takeoff from Edwards AFB, California, aboard the Boeing 747-123 Space Shuttle Orbiter Carrier, bound for Cape Kennedy, Florida.

It is a future without hope. It would not add to the nation's security. And it would all but eliminate the Air Force from any chance of implementing a mission whose pursuit is in everyone's interest—not least of all its own.

4. *The United States government should initiate talks with the Soviet Union and other interested nations with a view toward a major new international effort in deep space, with the Air Force acting as lead operational agency for this country.*

It should be a spectacular undertaking, involving the creation of whole new technologies, capable of exciting the imagination of citizens of the participating nations and of the world at large.

I would propose a manned spaceflight to the planet Mars. As a matter of fact, such a flight was once the primary target of space planners. In 1952, Wernher von Braun published a paper entitled "The Mars Project," in which he detailed the basic requirements for manned flight to Mars, then concluded: "Neither the scale nor the expense . . . would seem out of proportion to the capabilities of the expedition or to the results anticipated."

Von Braun envisioned "a flotilla of ten space vessels manned by not less than 70 men." Hard to believe? The flotilla, he wrote in 1952, would be built with materials shuttled to an orbital staging area by 950 flights of a space ferry over a period of eight months. That space ferry is about to become reality as the space shuttle. And one of the shuttle's most intriguing near-term capabilities is for the construction of orbiting space stations that could attain the size of small cities.

During the 1950s, a series of conceptual design studies for the Mars project were initiated, and by the end of the decade NASA was actively considering an eight-man Mars expedition as our first major undertaking in deep space.

But in 1961, the Russians once again reshaped the direction of our interests when they sent the first astronaut into earth orbit, and it became known that they were contemplating a lunar orbital flight.

Within days, President Kennedy was calling on his advisers to come up with a space project that would be dramatic and that we would win in comparatively quick time. It was concluded that the Soviets, with their more powerful booster rockets, might beat us to the vicinity of the moon, and move into orbit around it; but they lacked the technological sophistication to pull off a landing. A lunar landing project would thus allow us, in a way, to leap over the Soviet lead and launch a project on equal footing but employing the broader resource base which we had (and still have). It worked.

Nevertheless, NASA continued its Mars researches. Von Braun always considered the lunar project as only a detour from the more ambitious and potentially fruitful goal of a manned expedition to Mars. Between 1961 and 1966, about 60 study contracts for manned planetary exploration were awarded to aerospace companies and consulting agencies, including Lockheed, Ford, General Dynamics, and North American Aviation (now Rockwell International). There was general agreement that the Mars project was feasible and promising from every point of view.

But by the mid-1960s, the nation was beset by war abroad and turmoil at home. The space program came under increasing attack as an unnecessary expense. Better to use federal funds for a war that nearly shattered our military's morale, or for extravagant social programs whose wastefulness it would take a decade to discover.

In February 1969, as Apollo was drawing to a close, President Nixon created a Space Task Group to propose new initiatives. A historian of that decade reports that the NASA Administrator argued for a new program of major scope. It was important, he said, that the superb team assembled for the

Apollo project, including a number of private contractors, be kept together and advancing on the space frontier. (At Apollo's peak, an estimated 400,000 workers were involved in some aspect of its development.) Someone asked: What about the Mars project? But after discussion, the planners felt forced to conclude that Congress and the people were not in the mood for expansive new adventures on the scale of Apollo. The nation was turning inward, in reaction to the 1960s catharsis, and this time there was no Soviet space challenge to catalyze public emotions and loosen federal purse strings. The Mars project was shelved once again.[2]

Well, we have now experienced a decade of inwardness, and it has left us with unprecedented inflation, economic stagnation, declining productivity, rampant cynicism toward institutions of business and government, and self-centered social fragmentation.

If only as a unified effort to revive the spirit and the innovative energies of the American people and to involve our institutions in an act of undisputed grandeur that would exceed in conception even the most extravagant expectations of our Founding Fathers, the Mars project is not only timely but also desperately needed.

And why not involve the Soviets? We already have undertaken a joint space project with them—the 1975 Apollo-Soyuz mission—and it proved a resounding success, from the joint training missions in both countries to the actual docking in space. Later, we each sent separate probes to Venus; that makes neither scientific nor economic sense. It does not even make political sense, unless one is to preclude the search for accommodation as a legitimate object of politics and pretend that the antagonism between the United States and the Soviet Union is genetic.

And who knows what other forms of international cooperation might evolve from a project so noble in conception? Apollo-Soyuz and Spacelab (being built by an 11-nation European consortium for the space shuttle program) are but hints of what the future in space might portend. What if the international space team met and triumphed over unexpected adversity? The effect on global tensions would be salutary, to say the least. Should we not seek to exploit this future filled with promise as opposed to a future recoiling upon itself?

What would be more likely to keep pilots in the Air Force—the prospect of a leadership role in a major national commitment to manned spaceflight taking pilots and crews on daring journeys to the outer planets and beyond, or the prospect of operating ICBMs, remote control laser beams, and particle beam weapons, for the most part from isolated bases buried deep underground?

Furthermore, Soviet participation would reduce our monetary contribution by about half, yet our more diversified industrial plant would be in a better position to exploit the inevitable technological spin-off. If the Soviets wanted to keep pace with us in the space program and also exploit its terrestrial by-products, they would have to reduce the ratio of their weapons investment. Failure to do so would only cause them to slip further and further behind us in the most dramatic and prestigious undertaking in human history; it also would raise the real possibility that they might be outdistanced by other participants, such as Japan, China, and the Common Market nations.

And if they could be drawn into a major space enterprise, the Soviets would be far less likely to subvert a treaty closing space to armament and opening it to exploration and development; especially since, at this point in time, the decision would involve not so much disarmament as the *initiation* of a space exploration program *rather than* a space armaments program. And, unlike the current relationship, it would not invite dangerous

posturing, uneasy suspicion, and a climate of glaciation wherein a "freeze" on activity is viewed as progress. Instead, it would require an awesome outpouring of energy, including the creation of whole new technologies, in a decongealing climate of joint interest and shared aspirations.

At present, parity between the world's two great powers is discussed, when it is discussed at all, in terms of mutually assured destruction. A major point project in deep space would establish alongside that hopeless vision another that can only be discussed in terms of mutual survival. The prospect of ballistic missiles joining in a global holocaust would be matched with the prospect of fleets of spaceships joining on daring missions to the edge of the universe.

Then, let the two visions of the future and the institutions built to sustain them compete for support within the defense establishment. The outcome, I suspect, would surprise those who contend that the so-called martial spirit is attracted only to the conduct and contemplation of war. For deep space offers challenges infinitely more dangerous, more complex, more awe-inspiring than anything the Soviet war machine might conjure. The conquest of that darkly terrifying vastness, rather than some M-X shellgame played out on a tiny and forsaken scrap of desert, is a mission worthy of the United States Air Force.

Washington, D.C.

Notes

1. For a detailed account, see *NASA Office of Defense Affairs: The First Five Years: December 1, 1962, to January 1, 1968.* A memoir by W. Fred Boone, Admiral, USN (Ret), Historical Division, Office of Policy, NASA, Washington, D.C., December 1970.

2. A valuable summary of the Mars project is presented in *Man on Mars: The Mission that NASA Did Not Fly.* Paper presented by Dr. Edward C. Ezell at the annual meeting of the American Association for the Advancement of Science, Houston, Texas, 3-8 January 1979.

Man must rise above the Earth—to the top of the atmosphere and beyond—for only thus will he fully understand the world in which he lives.

Socrates

ENERGY ISSUES AND TIME AVAILABILITIES

AMBASSADOR JOHN PATRICK WALSH

Weep with me, all you that read this little story . . .

"Epitaph on S[alathiel] P[avy], a
Child of Queen Elizabeth's Chapel"

Ben Jonson

WE LIVE in an era of kaleidoscopic change and growing turbulence. International order is under considerable strain, and terrorism leaves its bloody marks across the spectrum of nations. With unease, we note that the crust of civilization is thin and that barbarism has increasing vigor. Global population moves relentlessly toward disastrous levels. Refugee numbers are terribly high, malnutrition is widespread, and starvation afflicts individuals, peoples, and regions. The ratio between population growth and food production is close, and the outlook is disquieting. In an informational and economic sense, the world is increasingly interdependent, but the intertwining of national destinies in these respects does not seem to enhance comity between nations. The world is scarred by war and violence. Nations are heavily armed and they bristle with antagonisms. Relations between the great powers are in the danger zone. The vast

Soviet military buildup and related foreign policy adventurism, culminating in the invasion of Afghanistan, have compelled a response from the industrial nations. The Strategic Arms Limitation Treaty is in the salt barrel, and the arms race is accelerating. This is a dangerous situation.

Underlining this malaise is a disjunctional situation in respect to oil, a vital raw material. The world as a whole, and the United States specifically, is confronted with very serious energy problems. The inherent dangers cannot be ignored, nor can they be wished away. In fact, the economic burdens and discontinuities relating to the existing energy situation could be quickly and enormously magnified by decisions and events exogenous to the energy-importing countries. The potential for domestic and international crisis clearly exists. Effects of the deteriorating situation are widespread, encompassing political, security, economic, social, and psychological consequences, which tend to interrelate in a synergistic manner. While the resulting burdens are unevenly distributed, no segment of the world is immune, and implications for the future are grave.

For more than a quarter century, economic growth was stimulated by the ready availability of cheap oil. The high economic growth rate in turn contributed to political stability, national security, and social adjustments. Despite its problems and conflicts, it was a halcyon period of human progress. However, in more recent years the global scene has become much more troubled with adverse consequences for national and global stability. Governments everywhere search for meaningfulness, and political and societal tensions grow within and between nations—all occurring against a backdrop of the wide distribution and heavy accumulation of lethal weaponry. The current scene is dynamic and the outlook for the eighties is troublesome. A key element in the deterioration has been a major shift in the availability and cost of oil in international markets.

The likelihood of further price increases is intensified by the reality that current petroleum price levels are below the indicated costs of substitutional fuels. In addition to cost factors, there are time constraints; and nuclear energy, coal, and synthetic crudes also embody serious environmental problems. Solar energy, broadly or narrowly defined, is superior in an environmental sense, but it will be many years before its output reaches truly significant levels. At some time, substantial volumes of energy other than hydrocarbons will be available, but getting from here to there will be a painful and dangerous transit. Unfortunately, there are no quick fixes to the energy problem. The dynamics of the oil situation represent a clear and present danger to world economic and political stability.

Energy supplies, including solid fuels, crude oil, heavy oil, natural gas, nuclear, and hydro/geothermal sources, are unevenly spread around the world. In terms of proven reserves, coal is the most significant fuel. Known reserves of oil and natural gas are far thinner.

North America is the most significant repository of energy reserves, although not of oil. In an overall sense, the United States is the largest single producer of energy, followed by the U.S.S.R. Proven reserves of global oil are estimated at about 652 billion barrels. Over 70 percent of this total is held by members of the Organization of Petroleum Exporting Countries (OPEC), primarily concentrated in the Persian Gulf region. The heavy daily flow of oil out of this area lends credence to the belief that the Strait of Hormuz is the most critical throttle point in the world.

In addition to known reserves, it is estimated that there are vast supplies of undiscovered oil. There are considerable uncertainties, however, about how much, when, and at what cost these supplies will be pro-

duced. The likelihood of discovering major new fields is not bright. Much of the world's future supplies seem more likely to come from fields in expensive environments, from smaller fields, and from more efficient extraction from existing fields. At existing and traditional production rates, the supply/demand ratio will tighten during the eighties unless new oil resources are found at a more rapid pace than heretofore. If reserve levels are not maintained, production will probably decline, which will be reflected in higher prices and increased competition for existing supplies. This in turn will intensify the effort to switch to other energy sources and change consumption patterns. The process would dampen economic growth rates and probably be particularly harmful to aspirations of those developing nations with relatively weak export earning capacities.

The three largest oil producers are the Soviet Union, the United States, and Saudi Arabia. Production has peaked in the United States and may have peaked in the Soviet Union. Maximum sustainable Saudi output is unlikely to reach levels previously expected.

Saudi Arabia remains, however, the most significant oil exporter, providing about 30 percent of total OPEC exports. Current Saudi offtake approximates 9.5 million barrels per day (mbd). While its potential production capacity apparently exceeds 10 mbd, it may have reached its sustainable level. Present development efforts should result in higher productive capacity in the years ahead, probably peaking at around 12 mbd, substantially below the 16-20 mbd capacity suggested earlier. The lower level estimates reflect a variety of factors, including technical problems in the fields and increased appreciation of the potential financial advantage in husbanding the reserves.

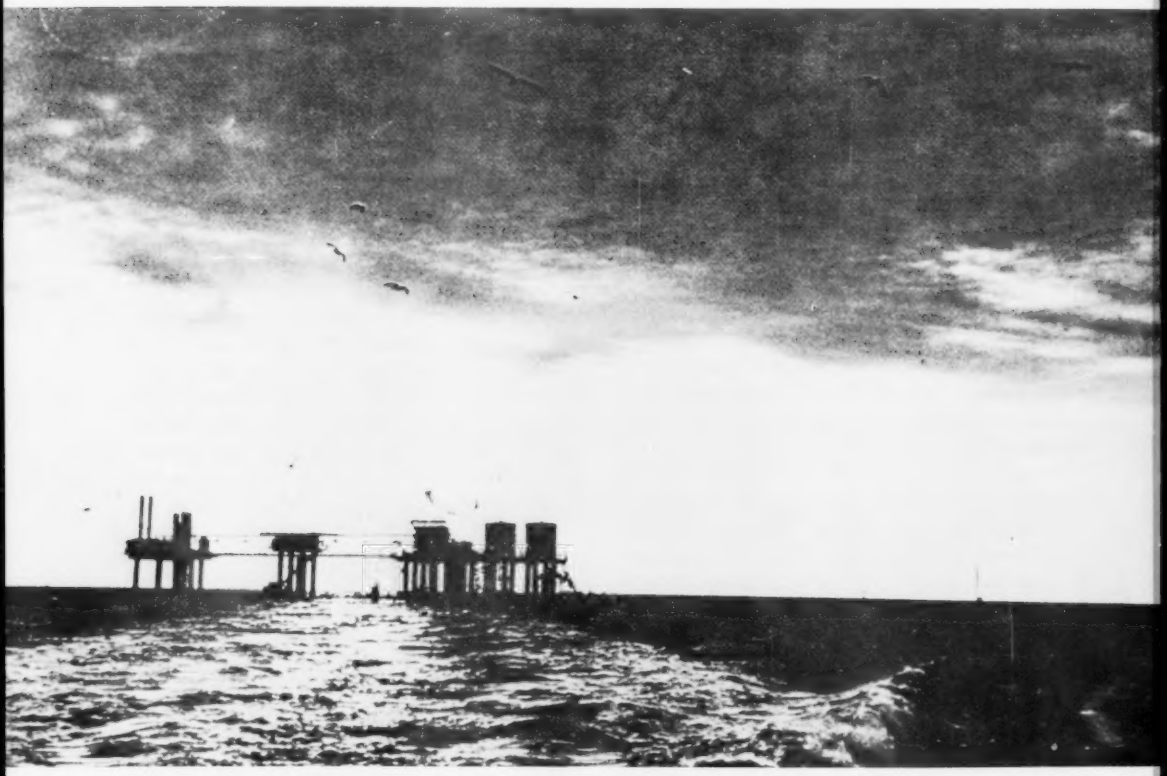
The Saudis remain the most significant OPEC member, but their effectiveness as a residual supplier is less than in past years. Since they are at or close to their peak offtake capacity, they cannot further dampen prices by expanding production. At existing high price levels, other members can optimize their earnings at offtake levels below their capacities. In the process, they can tighten the supply/demand ratio, maintaining upward pressures on world prices. Coercing the world in this manner, however, entails political and economic costs. The countries most capable of doing it are inherently weak entities. It is hardly a safe way to win friends and influence people. Furthermore, their fiat-price increases are weakening the countries on whom they are ultimately dependent for their security.

The U.S.S.R. remains the world's largest oil producer, but it is falling short of production goals for oil and other energy sources. Its western fields are nearing depletion, and its main Siberian field, Samotlor, may already have peaked in production. To maintain production levels, the Soviets will have to bring in new fields in more remote Siberian regions in the face of severe environmental, transportation, and technological problems. The outlook for increased natural gas production appears more favorable than the outlook for oil. Capital costs will be very high. Developmental delays would curb their export capacities and perhaps force them into an import mode. Either would tighten global supplies. Soviet supply difficulties are already reducing their ability to meet the energy requirements of the Communist countries of eastern Europe. This, in turn, is straining their limited foreign exchange reserves as they buy oil on the world market. Barter arrangement with the OPEC members will be difficult to negotiate. Nevertheless, the indicated and probable reserves of the Soviet Union are substantial, and it may be in a favorable reserve position relative to the United States at the end of the decade.

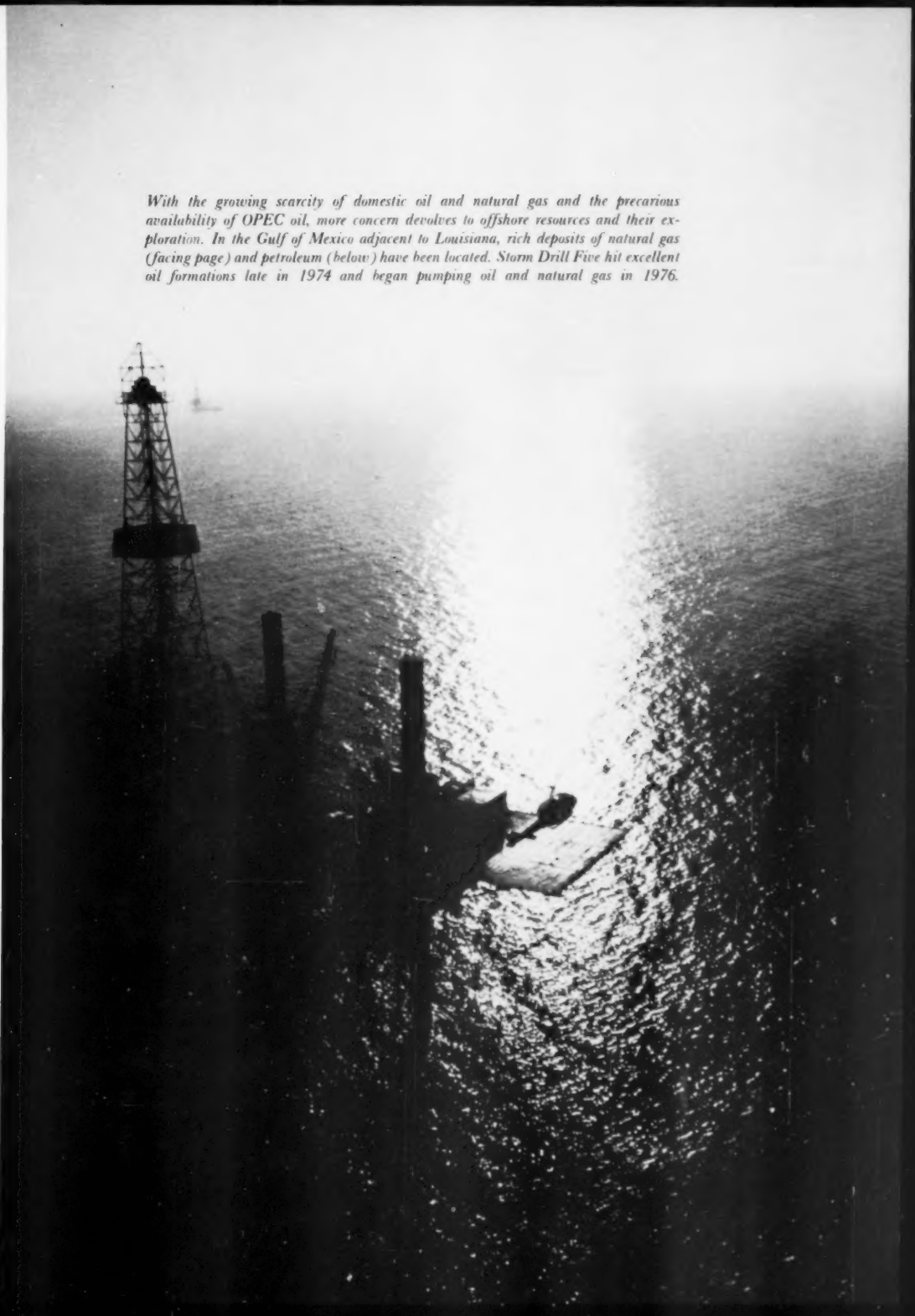
The American energy situation is complex and troublesome. The U.S. remains the

largest producer and consumer of energy, producing major supplies of oil, natural gas, and coal. In addition, it derives considerable electrical energy from nuclear and hydroelectric facilities. At the same time, however, it consumes more energy than the combined total for Western Europe and Japan, including nearly 30 percent of the world's oil production. Since the demand considerably exceeds the domestic supply, the United States is the largest oil importer. Other industrial nations, however, are more dependent on oil and oil imports than the United States.

The energy production outlook is not sanguine. The gradual decline in the production of oil in the lower 48 states continues. The mainland has been extensively explored, and the likelihood of major new finds appears small. Higher oil prices should stimulate production from existing and abandoned wells, but this may not do more than counteract the existing downward production trends in the operating fields. Exploration off the continental shelf in the Atlantic remains inconclusive. North Slope production could be increased if additional pumping facilities were added to the Alyeska pipeline, but there



With the growing scarcity of domestic oil and natural gas and the precarious availability of OPEC oil, more concern devolves to offshore resources and their exploration. In the Gulf of Mexico adjacent to Louisiana, rich deposits of natural gas (facing page) and petroleum (below) have been located. Storm Drill Five hit excellent oil formations late in 1974 and began pumping oil and natural gas in 1976.



are limits to this process. Higher price levels have increased natural gas output but have not as yet resulted in higher reserves. However, deeper drilling could prove beneficial. Access to northern Alaskan and Canadian gas reserves remains dependent on the arduous, expensive, and time-consuming task of pipeline construction. Despite their considerable potential, the coal and nuclear industries remain troubled, and output in this decade will probably lag well behind previous forecasts, increasing the pressure on oil and natural gas supplies. The production of significant volumes of synthetic fuels will not be available for many years. Under these circumstances, the energy supply and demand ratio seems destined to remain precarious. We will be dependent on imported oil for many years.

THE dilemmas involved in formulating and implementing national and international energy programs are substantial. There are no ready, certain, or painless solutions to the production, supply, financing, and use of energy. Potential courses of action tend to conflict with anti-inflationary programs, to divert capital, and, at least in the short-term, to dampen economic growth and international trade. Despite extensive research efforts, technological breakthroughs have not occurred. For years to come the world will remain heavily dependent on existing forms and finite supplies of energy. In view of pricing, supply, and demand factors, hydrocarbon exploratory efforts are at relatively high levels and should be intensified in the future. Additional supplies will be found and developed, but their magnitudes are uncertain.

In the past, major oil finds have been infrequent and are likely to remain so in the future. It has been about a decade since the discovery of the Prudhoe Bay and North Sea sources. Since then the only new major fields have been in Mexico. The magnitude of the reserves in the western overthrust region is uncertain, but this is a promising field. The difficult area in the waters off Newfoundland may also be rewarding. Areas in the South China Sea and off the shores of Argentina appear promising although exploratory efforts are impeded by political and other factors. A plethora of smaller fields in the developing countries might materialize if the necessary international financing is forthcoming.

The outlook for additional natural gas sources appears more favorable. The hydrocarbon potentialities, particularly for natural gas, are encouraging in Siberia and in the Beaufort Sea, but the environmental and logistical problems are severe; the process of exploration and development, if merited, will prove long and costly. Meanwhile, consumption continues to eat into proven oil and natural gas reserves.

In terms of available reserves, coal is underutilized. If energy requirements are to be met in the future, coal will have to be used to a greater extent as a boiler fuel and in the form of gasification and feedstock for synthetic crude. Environmental costs will be inevitable. The significance of coal in international trade, particularly for the United States, will increase. This will necessitate extensive development in the coal fields and major improvements in railway, storage, dock, and shipping facilities.

The image of nuclear power is badly tarnished. While nuclear power facilities and output continue to grow, the rate is substantially less than had been expected. Previous projections of nuclear capacity in this decade are unlikely to be realized.

All nations produce and consume energy, and all are dependent on it for their well-being. Thus, it is a significant element in world trade, with oil as the dominant factor. In view of the discrete location of oil supplies, the trade is dominated by a group of nations far smaller in number than the oil-importing

nations. The 13 members of OPEC have the capacity to control the supply and price of oil on world markets. Political tensions are an inevitable consequence of this situation. OPEC's fiat-pricing decisions have been a major problem for the oil-importing countries. The organization enjoyed a certain vicarious popularity among the developing countries for some years, but this prestige has eroded with time. High oil prices are a serious burden for the developing countries, and that burden has not been effectively eased by the various OPEC compensatory efforts.

OPEC is a unique organization. Its geographical distribution is very wide. There are considerable variations in the productive capacity and reserve positions of its members; they are politically diffuse and differ in physical size, population levels, cultures, economic requirements, and per capita incomes. Some members are net borrowers on international markets, while others have accumulated vast financial reserves and have significant foreign investments. In general, however, they are developing countries, faced by all the problems inherent in the modernization process, trying to exploit finite natural resources in order to finance economic development. The favorable market conditions permit them to exact high prices for their commodity. While their revenues are substantial, they confront many difficulties in creating viable agricultural and industrial productive bases; their newfound economic power is hardly an unmitigated blessing. Domestic political stability in most is precarious.

In view of the disparities among the members, it is not surprising that there are disputes within the organization over pricing and supply policies. In a general sense, they have agreed to price guidelines based on the Gulf price of Saudi light crude. Prices have varied from this base depending on quality, production costs, transportation costs, and other factors. However, when demand has been high, individual exporters have charged whatever the traffic would bear including surcharges, based on administrative and political conditions.

The vast bulk of OPEC oil is sold on a contractual basis. In the past, the international oil companies played an efficient middleman role between the exporting and importing countries. This role has been greatly reduced, however, as the result of the decisions of the oil producers to reduce supplies to the companies. As a minimum, this has diminished the efficiency of international oil transactions and has raised questions about the ability of the members of the International Energy Agency to share oil supplies in emergency conditions.

About 5 to 10 percent of the international oil trade is sold on the spot market, usually at premium rates. This market can play a useful role in the marginal adjustment of supply and demand. In periods of shortage, however, it can also stimulate upward price movements. This was apparent in 1979 when the oil importers contributed to the surge in oil prices by their competitive buying efforts on the spot market.

The events of 1973-74 and 1978-80 created disruptive conditions in the world oil market with far-reaching economic and political consequences. Following the outbreak of the Yom Kippur War, most of the Arab members of OPEC embargoed oil exports. The severity of this blockage was gradually eased but not eliminated until May 1974. In the interim, certain non-Arab suppliers increased their sales. The political consequences within the Western alliance were more troublesome than the economic consequences. The subsequent OPEC decision to raise oil prices some 400 percent, effective 1 January 1974, had more serious and lasting effects. This marked the end of the era of cheap oil and contributed to world inflation, recession, and payments disequilibrium. The

recession lowered the global demand for oil, somewhat dampening the exporter's capacity to raise prices. In the fall of 1978 the oil market was soft, accompanied by some shaving of prices. This situation seemed likely to continue, but the outlook was dramatically altered by the revolutionary events in Iran, which forced a stoppage of oil production. This withdrew about 5 mbd from the world market, which was partly compensated for by increased offtake from Saudi Arabia and several other OPEC members.

In late 1978, with demand at existing prices exceeding supplies by about 1-2 mbd, price increases were inevitable. The questions at issue were the magnitude of the increases and the manner in which they would be implemented. OPEC was united on higher prices but split in respect to the new levels. For some members, the objective was an optimum return which took into account the effects on the world economy while simultaneously emphasizing the need for oil conservation; for others, it appeared to be to maximize returns with little or no concern for the global economic consequences. The views and concerns of the oil-importing nations were of little relevance in the OPEC considerations.

To a considerable degree, the price formulations of the past 18 months have represented the discrete decisions of individual governments rather than collective OPEC decisions. The system has involved multiple pricing levels and repeated price leapfrogging, resulting in increases of about 130 percent and an average midsummer crude oil price of about $32 a barrel. Despite a decline in OPEC offtake from a peak of about 31 mbd to a current offtake of about 28.5 mbd, oil is in surplus on world markets. This reflects increases in non-OPEC production and slackened demand. The latter is the result of high prices, reduced economic activity, and improved energy efficiency. An additional factor is the existence of high oil stocks in the importing countries. Under these circumstances, prices are relatively soft although at very high levels. This situation probably will prevail into the fourth quarter. In the short-term, economic activity is unlikely to stimulate demand. However, concern about the safety of supply lines and the possibility of further arbitrary price increases may result in anticipatory buying before the end of the year. If this occurs, it will reinforce the inclinations of the price-hawks in OPEC. This highlights the need for the industrial

The pursuit of oil extends from ocean floor to mountain fastnesses. A difficult section of the trans-Alaska pipeline is buried above Keystone Canyon northeast of Valdez by the Alyeska Pipeline Service Company.

countries to reduce their dependence on imported oil, which will require the use of alternative energy sources and increased energy efficiency. This will be a time- and capital-intensive process.

THE industrial countries differ widely in terms of per capita energy consumption, the significance of oil in their energy mix, and the degree of dependence on oil imports. This produces variances in their approach to the energy problem and complexities in their efforts to forge common energy policies. Canada and the United States, for example, are the highest per capita energy consumers, suggesting that they have the greatest potential for conservation; the United States is the most significant energy producer and consumer; and Japan is most heavily dependent on oil as a fuel and most dependent on oil imports.

The relative cheapness of oil in the pre-1974 period was conducive to economic growth, but it stimulated oil consumption and hampered the use of alternate energy sources. Throughout the postwar period, oil and natural gas have been the dominant fuels in the industrial sector of the world. Since hydrocarbon reserves are finite, this intensive fuel consumption cannot continue indefinitely. However, despite the tenuousness of oil supplies and soaring oil prices, rising by a factor of more than ten in less than six years, the global preeminence of oil has not changed. The coal and nuclear power industries remain troubled, solar energy is at an early stage of development, and the various sources of synthetic crude have not emerged from a research status. Despite the urgency of the time element, the reaction of the industrial countries has been slow and indecisive.

In an era of faulted leadership, the industrial countries have drifted with the problem. Adjustments in the developing countries have been hampered by the paucity of alternative energy sources and the tightness of their technological and capital base. Governmental action has been far exceeded by governmental rhetoric, which in the process has contributed to public confusion and malaise, especially in the United States. Three consecutive Presidents have issued ringing calls for corrective action with reluctant and belated response from Congress and the public. Only now, in this season of our discontent, does the American public appear ready to agree that the energy problem really exists. It remains to be seen, however, if the people and their elected representatives will have sufficient wisdom, cohesion, and willingness to deal effectively with the existing and growing morass. The need for individual and collective sacrifice is not a popular rallying call or unifying factor. The search for scapegoats continues, corrective measures have few advocates, and shrill opponents abound.

The time lost can be lamented but not regained. The energy problem cannot be solved in the short- or medium-term. It is replete with costs, paradoxes, contradictions, and frustrations. Technological innovations are to be sought, but, even if found, their substantive benefits will be long delayed. However, the problem in its myriad complexities can be better managed, although not without serious societal, economic, and political costs. Sacrifice, with its unpleasant connotations, will ultimately regain its erstwhile prominence in our lexicon. At least in the short-term, economic growth will be restrained and inflation stimulated by the exigencies of the energy problem. This reality will stretch deep into the present decade.

The energy issue is embedded in macroeconomic policy formulation. Stable economic growth is now dependent on the efficiency of energy utilization and particularly on the conservation of oil. Sound energy policy is likely to complicate anti-in-

flationary efforts. Each nation must improve its management of energy resources while recognizing its dependence on other nations. In this respect, the industrial countries have heavy responsibilities. The seven largest industrial states currently consume about 65 percent of the world's oil production, and they are heavily dependent on imported oil. They possess far greater leeway in curbing import demand than the developing countries.

Since the beginning of the new energy era in 1974, the responses of the industrial countries have been hesitant, disparate, and collectively inadequate. This was a contributing factor in the 1979-80 surge in oil prices along with the rapacious desires of some of the OPEC members. Some improvement in energy efficiency has occurred, reflecting price and balance-of-payments pressures. This time-burdened process will gradually become more effective as a factor in reduced import demand.

The severe recession of 1974-75 temporarily curbed demand. Subsequently, as global economic activity revived, it was accompanied by a gradual increase in oil import requirements. The United States, which paced the economic advance, also led in expanded import demand. American imports peaked in 1977 at about 8.6 mbd before the flow of oil from Prudhoe Bay reached significant and sustained levels. As the economy slackened in 1979 and fell into recession this year, energy consumption and oil imports declined. Imports in 1980 will probably average about 7.3 mbd. High prices and increased efficiency are related factors.

At their peak, U.S. imports were more than 40 percent above the levels of 1973. Japanese imports increased moderately in the comparable period while Western European imports remained somewhat below 1973 levels, in part because of the increasing availability of North Sea hydrocarbons. The strength of American import demand provided the economic underpinning for earlier OPEC price increases. But, in the past 18 months, the rate of reduction in American imports has exceeded that of the other industrial countries.

For the past six years, the industrial countries have thoroughly explored and debated the spectrum of energy issues. In a collective sense, the Organization for Economic Cooperation and Development (OECD), the International Energy Agency (IEA), and the annual economic summit meetings have provided useful forums. The net effect in terms of positive corrective decisions, however, has not been impressive. Individual and collective discussions with the members of OPEC have been inconclusive.

The annual summit meetings have provided capstones to the regular economic considerations. The last two, held in Tokyo in 1979 and in Venice this year, were particularly focused on energy issues. To the participants, the surging oil prices presaged more inflation, less economic growth, higher unemployment, and increased balance-of-payments problems. The nonoil-producing developing countries were deemed particularly vulnerable. It was the somber conclusion at Venice that unless the industrial countries are able to deal effectively with their energy problems, they would be unable to cope with other economic problems.

The most urgent tasks identified were reducing oil consumption and expediting the development of other energy sources. This, if realized, would help break the existing link between economic growth and oil consumption. More precisely, they foresaw a reduction to about 0.6 percent in the ratio between the increase in collective energy consumption and economic growth. Simultaneously, they forecast lower levels of oil consumption in 1990 than in 1980. This would be accompanied by a decline in the oil share of total energy consumption from its present 53 percent to about 40 percent.

To conserve oil, they agreed that electrical generating capacity should be shifted to other fuels where possible. Furthermore, intensified efforts would be made in the industrial, transportation, and commercial sectors to improve energy efficiency.

They remained committed to intensified efforts to expand indigenous hydrocarbon resources, but they recognized that the energy needs of future economic growth should be met by fuels other than oil. In this respect, they identified a potential capacity to increase by the end of the decade 15-20 mbd of oil equivalents from other energy sources. This would involve doubling coal production and use, enhanced use of nuclear energy, and a substantial increase in production of synthetic fuels, solar energy, and other sources of renewable energy over the longer term.

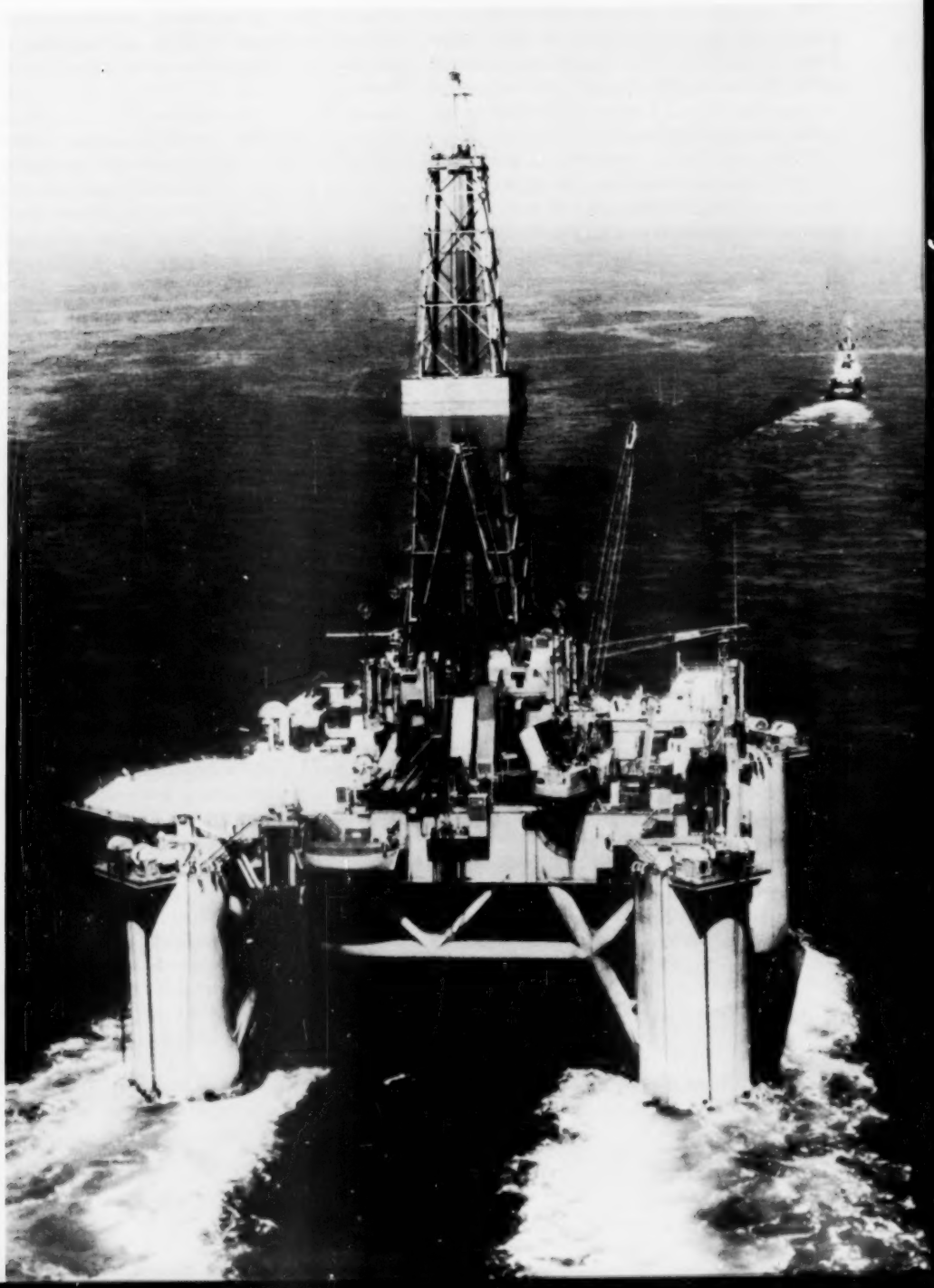
The goals and objectives of the Tokyo and Venice conferences reflected the exigencies of the oil situation and a common recognition of the need for cooperative action. The execution of energy policy, however, is fundamentally a function of the individual countries. As independent entities with varying problems and levels of leadership, there will be considerable variances in their performances. And, in most aspects of energy policy, substantial delays will be involved. It remains to be seen whether their individual and collective responses will be commensurate with the problem. Related to this is the time factor, which could be truncated by political instability particularly in the Persian Gulf area. Dependence on the fragile political structures of that region for vital oil supplies is a prescription for living dangerously. Major supply interruptions could occur as quickly as a summer storm.

THERE is a strong inclination to blame OPEC for the world's energy problems. There may be psychic satisfactions in this, but the validity of the charges is conjectural. The oil-importing nations have remained profligate in their consumption of this finite fuel despite the grave warnings embodied in the events of 1973-74. Their high demand levels have made OPEC's fiat price decisions possible. In essence, this moved forward the time sequence for a higher price structure that would otherwise have occurred in the early years of the 1980s. The willingness of the oil exporters to expand offtake to meet rising world demand is highly questionable. In the absence of effective conservation measures and the use of substitute fuels, the world will be faced with increasing tension and economic disorder. The curtailment of existing international supply levels would have serious consequences. OPEC is a reality with which we must live. Military threats against its members are not credible, and economic measures would not be effective.

Despite the widespread dislike for OPEC, some form of oil exporter association is in the world's interest. The oil importers and exporters must cooperate for their mutual benefit. Both have attested to the need to reduce oil import demand. One way to do this, although it is a time-intensive process, is to develop alternate fuels. OPEC is not a philanthropic organization, but it is conceivable that the richer and more liquid members would be prepared to participate in the financing of facilities, particularly if the return on their money were deemed adequate. They cannot prosper or be secure in an inflated and recessed world economy.

The economic consequences of the high cost and uncertain supply of oil in world markets are grave. The substantial price increases that have already occurred will drain resources from other goods in national and international trade and will further distort investment patterns. This in turn adversely affects productivity, growth levels, and inflation.

In addition, the financial consequences of the ongoing surge in oil prices are enormous.



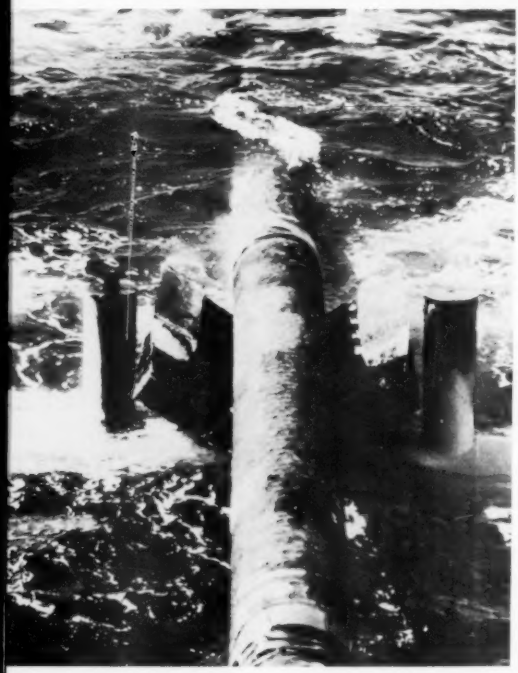
Even with the availability of North Slope production for the full year, the U.S. oil import bill in 1978 was $43 billion. The 1979 oil imports approximated $60 billion, and they will exceed $80 billion this year. This is the major factor in the continuing U.S. trade and current account deficits, which in turn accentuate the strains on the international value of the dollar. The outlook for the industrial countries as a whole is roughly similar, with inevitable production, balance of payments, and inflationary strains. No country will be immune from the consequences, although patently some have better capacity to handle them than others.

The consequences for the oil-importing developing countries will vary considerably, but they will be serious for many. Direct and indirect costs of the OPEC increases in the past two years more than doubled the oil bills of these countries, which now exceed $50 billion. Increased inflation, retarded growth, financing difficulties, and political strains appear inevitable.

In the 1974-78 period, the international monetary system effectively processed the vast flow of funds to and from the OPEC countries. About 75 percent of the OPEC surpluses was handled by the Western financial intermediaries to a considerable degree to finance the current account deficits of industrial and developing countries. The external debt of the latter has reached impressive levels, and at least some of the less developed countries will encounter increasing difficulty in arranging private market financing. Furthermore, some of the commercial banks are reaching the limits of their exposure in individual countries.

The cumulative current account surpluses of the OPEC members, largely accumulated by the small Arab countries, have been substantial. As a result, however, of considerable import absorptive capacity, the net OPEC surplus dropped to low levels in 1977 and 1978, easing the recycling burden. This trend has been reversed. The surplus this year will approximate $115 billion, reflecting higher gross earnings and slackened import demand. The effect on economic growth, world trade, and financial markets will be increasingly harmful if the accumulations continue in the years ahead. As a minimum, new international financing facilities and methods would be required.

Oil has never been one of our more accessible resources, but the rich North Sea oil deposits are among the most remote. The pipeline (below) to the Brent oil fields will carry oil 100 miles to the Shetland Islands. The newly welded 36-inch undersea pipeline rests on a "stinger," which eases the angle of inlay into the water. . . . The drilling vessel (facing), the semisubmersible Zephyr #1, works in the frigid North Sea waters 80 miles east of the Shetland Islands, northernmost tip of Britain.



The soaring prices and tightening supplies of oil have indelibly marked the economic, political, and strategic structure of the world. They have been deeply revolutionary in nature with adverse consequences for world confidence and equilibrium. To a considerable degree, the short- and medium-term economic future of the world depends on the decisions, economic or political as they may be, of the oil-exporting countries. Another sharp reduction in supply similar to that following the Iranian revolution would ripple across the globe. And in this respect it would be unwise to overlook the societal fragilities of most of the members of OPEC.

The adverse consequences of the price rises since the beginning of 1979 are serious. At least for the next several years, the disorienting effects will be reflected in lower production, higher prices and unemployment, and greater disequilibrium in international trade and payments than would otherwise have occurred. Further increases in the near-term could result in payment defaults and political instability.

The economic outlook in the post-1982 period is blurred by the uncertainties of oil supply and costs. On the demand side, the rates of economic growth, efficiency of energy usage, level of oil consumption, price of oil, and rate of development of hydrocarbon and nonoil energy supplies in the oil-importing countries are of fundamental importance. Global recession would ease the oil supply and price pressures but only at serious economic, social, and political costs. On the supply side there are many imponderables, including the technical offtake capacity of the OPEC members; their political willingness to meet demand requirements; the question of continuing political stability; the possibility of supply impediments due to accident, sabotage, war, or embargo; and uncertainties about the continuing capacity of the U.S.S.R. to export oil.

Projections of the 1985 oil supply and demand balance continue to proliferate and vary, due essentially to differing assumptions, particularly in respect to rates of projected economic growth and likely Soviet export possibilities.

The economic implications are bleak. At least through the first half of this decade, robust economic growth rates seem precluded by tight oil supplies. Even modest growth rates in the industrial countries will necessitate higher oil import levels. Consideration of the years ahead highlights the significance of greater conservation, quicker development of nonoil energy supplies, and greater success in finding and exploiting non-OPEC oil supplies. Notable success in these areas appears to be the only way to avoid anemic economic growth rates. In any event, OPEC will remain the residual supplier on the world oil market. If demand continues to grow for its commodity, higher prices will be a minimum consequence. This would enhance the ability of the frail and disparate members of OPEC to influence world events. The inherent responsibility for the world's destiny would be unique in a historical sense.

This unfolding situation bespeaks serious political and strategic consequences. If the industrial world is to be limited to anemic growth rates, its individual members will be confronted with domestic political and social strains. This would be more likely to contribute to the spread of relatively weak coalition governments rather than to relatively strong and cohesive leaderships. Drift rather than positive, determined action might well be the hallmark of their policies. Economic stress is unlikely to enhance political cooperation and flexibility among nations. Some slackening in the growth rates of world trade appears inevitable. This will have adverse effects on the developing nations, particularly if it is accompanied by a falloff in capital transfers. In the developing countries, deteriorating economic conditions could halt

the embryonic movement away from military governments, probably accompanied by greater social unrest. Slack economic conditions will also have serious consequences for the debt-ridden Communist countries of Eastern Europe. The Soviets might derive vicarious ideological satisfaction from the distress of the industrial countries, but they would not be immune from the economic consequences of tighter trade and capital availabilities and continuing inflationary pressures. Furthermore, they will be confronted with substantial balance-of-payment problems if their energy problems result in a shift from a net oil exporter to a net importer position.

The heavy dependence of the industrial countries on OPEC supplies, particularly from the Persian Gulf area, is a factor that must be taken into account in their foreign policy considerations. Western European and Japanese concern about the safety of their oil supplies is manifest in their posture relative to Israeli-Arab issues. This was conspicuous during the Yom Kippur War. Since that conflict, the oil supply issue has also been a major factor in U.S. policy decisions. This trend is likely to intensify in the years ahead. Among other things, it probably will contribute to strains between the United States and Israel.

Threats from individual Arab countries, revolutionary Iran, and Nigeria are not infrequent and may increase with the passage of time. If the Arabs choose to resort to a boycott, the consequences would be more serious than in 1973-74. Supplies could also be curtailed by accidents in the oil fields, civil disorder, sabotage, or war. The possibilities of sabotage are omnipresent, particularly in the Persian Gulf area. To varying degrees, pipelines, pumping stations, storage depots, loading facilities, and tankers are vulnerable to attack from sundry dissident groups. The Middle East in particular is a tinderbox of conflicting national interests. Military skirmishes and localized wars are quite possible, with implicit danger to oil facilities and the oil trade. Under certain circumstances, such developments could lead to the involvement of exogenous forces with the intent of assuring continuing supplies. Military operations of this nature would be complex, and containment of the area of intervention might prove difficult. At a minimum, serious international issues would be involved.

For many years, U.S. and Soviet competition for influence in the Middle East and its environs has been a major factor in regional and world affairs. If and when the Soviets become dependent on foreign oil sources, the competition could be intensified. Under these circumstances, the two major powers might seek preclusive access to oil supplies with tension-raising possibilities. On the other hand, they would be likely to share resentments about soaring prices and supply restraints. Instability in the region could be harmful to the interests of both. The cutbacks in Iranian oil production and the stoppage of natural gas deliveries to the Soviet Union are pertinent examples of the hydrocarbon costs of instability.

With approximately two-thirds of OPEC's oil exports passing through the Strait of Hormuz, the Achilles' heel of the industrial countries is evident. This flow could be blocked in various ways with chaotic consequences. If the Soviets became involved in such a process, the dangers of major war would become acute. Blockage without their involvement would also raise serious dangers of broader conflict as efforts were made to rectify the situation, which could take a variety of forms and involve various combinations of nations.

Anwar Sadat may be premature in his judgment that the battle for Persian Gulf oil has commenced. But there is reason for concern about the safety of oil production in this volatile region. Iranian production is threatened by deepening domestic disorder and the

possibility of military clashes with Iraq, another major producer. War in the region could result in a severe curtailment of production and exports.

The Soviet Union is now deeply implanted around the periphery of the Persian Gulf, namely in Ethiopia and the Red Sea, in South Yemen and Socotra, and in Afghanistan. They also maintain substantial naval forces in adjoining waters. In response to the Iranian seizure of the American Embassy and its personnel and the Soviet invasion of Afghanistan, there has been a considerable buildup of American forces and equipment in the region. Arrangements are being made with Oman and Kenya for staging facilities, augmenting the more distant facility on Diego Garcia. Joint training operations are being conducted with the Egyptians. The Carter doctrine enunciates the reality that the Gulf and its oil are vital to American security. American-Soviet relations are in a global danger zone with particular precariousness in this region. Both parties should now proceed with care. In the turbulence of the Middle East, each could become a pawn rather than a mover of events.

THE OIL issue and related economic strains have broad implications for military structures. Maintaining and enhancing military forces are costly processes. Defense must compete with other national requirements for available resources, and inflation reaps its toll in defense budgets. This is likely to result in the reduction of training and operations. Counterbalancing the momentum of the Soviet military buildup will require higher outlays by the industrial countries. In view of their bleak economic outlook, this will increase the pain of allocation choices. Since the Soviet economic outlook is also bleak, they too will be confronted with consequential decisions in respect to resource allocations.

In addition to the problem of budgetary availabilities, military forces are faced with the direct issue of the availability and cost of oil. They are significant consumers in peacetime and voracious users in wartime. Maintaining adequate supplies and reserves of petroleum products is an imperative military requirement. It has broad implications, including the growing need to develop synthetic fuels.

The energy situation will have painful consequences for the United States. Since energy supplies cannot be significantly increased in the short-term, consumption will have to be reduced. The country is moving from a relatively low cost to a relatively high cost energy economy. This, coupled with energy regulations and supply factors, will force changes in living styles and standards. We are destined to pay the costs of years of energy profligacy and policy ineptness. It will serve no useful purpose to seek domestic or external scapegoats. Neither the oil companies nor OPEC is responsible for our dismal and dangerous situation. We disregarded the reality that oil production peaked in 1970. We did not exercise our various options to increase energy production and, in fact, hindered production by a maze of pricing, environmental, and other regulations. Our approach to conservation has been halting and incomplete. In essence, we have chosen to depend on increased oil imports to the point that supply limitations resulted in soaring prices and supply limitations. Furthermore, our heavy dependence on precarious Eastern Hemisphere sources has created serious potential dangers to our national security. Thus, the true cost of imported oil was far higher than the commercial rates.

BELATEDLY, a national energy program is falling into place. Price controls on hydrocar-

bons are being dismantled, accompanied by the imposition of so-called windfall profit taxes. A vast program has been launched to promote nonoil energy sources, which will exceed in magnitude any previous American capital expenditure effort. A conservation ethic is beginning to take hold in the country, and energy efficiency, particularly in the industrial and transportation sectors, is improving. But it is now late in the energy day. We remain heavily dependent on imported oil from sources of dubious dependability. Lacking an effective strategic petroleum reserve, we are vulnerable to supply reductions. The well-being and safety of the nation will ride in balance as the corrective process proceeds on its inevitably jagged and slow course. Getting from here to there in an energy sense will be a difficult process. We may be able to mitigate but we cannot avoid the consequences of our past and present derelictions.

Montgomery, Alabama

We are indebted to the following companies for photographs illustrating this article: Alyeska Pipeline Service Company, Continental, and Texaco; and we gratefully acknowledge the assistance of Richard E. Drew, of the American Petroleum Institute, who made them available to us.

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- The Soviet Union in the Age of Parity . . . a trilogy
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- Cultural Myopia

COAL A LONG-TERM ENERGY ALTERNATIVE

LIEUTENANT COLONEL ROBERT J. JAMSKY

OVER the ages man's energy problem has consistently been to develop the means to convert available energy sources from their native state to a form usable to perform a specific task. Worldwide energy resources are virtually limitless. However, as the more economically recoverable sources are depleted, there can be lags in developing the technology to exploit the less available energy resources. For example, it is estimated that the lead time for conversion of electricity production plants from liquid to solid fuel is five years.[1]

The ultimate source of all energy is the sun. The vast amounts of radiant energy received by the earth energize the photosynthetic processes of green plants. Plants

provide the basic material from which coal, natural gas, and oil have evolved. By heating the land and oceans, the sun sets in motion the processes that create rain and wind, making it possible for man to capture energy through windmills and waterwheels. (The only significant sources of energy not derived from the sun are nuclear power and the as yet untapped energy of tides.) Scientists describe energy with a common term *heat,* and the standard of measurement is the British thermal unit (Btu). Each Btu represents the amount of heat required to raise the temperature of one pound of pure water one degree Fahrenheit at sea level.

Man's first experience with combustibles is obscure. Perhaps volcanic action or lightning ignited savanna or forest, and fire became a tool rather than a transient phenomenon. Wood was the first of man's fuels. He was surrounded by seemingly endless tracts of forest, and it must have appeared that there was no limit to this energy supply. By the time of Babylonian, Greek, and Roman civilizations, man had learned to produce light from animal fats and vegetable oils and from pitch, a black, oily substance from the earth. With fire, man could operate on his own schedule; the day could be used for outdoor labor while the evening, now lighted, allowed time for tool repair and social activity.

Lost in the mists of antiquity is man's first encounter with a black, rocklike substance that could burn with a hot flame. There is archaeological evidence that coal was used by the inhabitants of Glamorgan, Wales, during the Bronze Age, 3000 to 4000 years ago. As early as the fourth century of the Christian era, Roman garrison troops in Britain burned coal to heat their baths and quarters. However, coal, the first-used fossil fuel, was not extensively used until the seventeenth century.[2] In the middle of the eighteenth century, wood was still the major source of fuel, but its limitations were now foreseeable. England's forests were denuded for charcoal used in smelting by the early eighteen hundreds. This is possibly the earliest example of resource exhaustion, a situation not unlike that faced by the world today with its depleting oil reserves.

The first mine shafts for coal extraction were sunk in the late middle ages. Records show that in 1684 near Bristol, England, there were 70 coal mines but only 123 miners.[3] The industrial revolution, with its massive need for energy to drive the newly invented steam engines, heralded the steady growth of energy requirements.

Coal has been a major energy source throughout industrial history. It became the primary source of energy for both domestic and industrial use. It fired the steam engines that turned throughout the industrial revolution. By 1700 England was mining more than a million tons annually. Metalworkers and brick, tile, glass, and earthenware industries made extensive use of the high-energy content of coal. The early chemical industry used coal in refining processes for saltpeter, alum, and gunpowder.

By the nineteenth century, the United States was extracting and transporting large amounts of coal on steam engines used by the steel, chemical, and electricity-generating industries. Coal was also used for making gas to light homes and streets. Solid fuel was dominant until early in the twentieth century when oil and gas began to make inroads into the fuel market. Trains were pulled by diesel-fueled engines, and natural gas, along with electricity, eliminated the need for local coal justification. The use of coal declined until it hit a low point of 400 million tons in 1958. Electricity producers now burned oil because it produced little particulate pollution and no residue. By 1960, coal was the fuel of an earlier age, thought to be unfit for use in modern technology. However, the user attitudes changed as both industry and government realized that gas and oil reserves were

not limitless. Coal began to receive renewed attention, and by 1970 the coal industry, after a 23-year slump, produced a record-breaking total of 602 million tons. By 1974, about 45 percent of the nation's electricity was produced from 400 million tons of coal.[4]

The OPEC oil embargo of 1974 was stark evidence that one of the basic elements of our economy, energy, was at the mercy of foreign powers. Coal and other energy alternatives then began to receive new attention.

Alternate Energy Sources

Since national security interests will be served by increasing domestic energy production, it is necessary to determine the best energy possibilities among several alternatives. Coal appears to offer the major short-term alternative to oil and natural gas, particularly for power generation and industrial use; furthermore, coal offers the most massive fossil fuel reserves in the world. The United States reserves of coal are estimated to constitute about 31 percent of the total world deposits, about 3.2 trillion short tons of the estimated world reserves of between nine and twelve trillion tons.[5] With the general recognition that world oil production will probably peak and decline during the next 25 years, nations will be forced to exploit alternative energy sources. Coal is not as easy to extract, transport, or burn as nonsolid fuels so a transition to a coal-based economy will call for strong incentives and changes in attitudes toward coal. Making coal both available and acceptable will require major expansion of mining, processing, energy extraction, and research on utilization technology. Projections indicate that the nation will have to increase coal production from 60 to 300 percent to fill expected energy needs.[6]

Although one piece of coal may look much like any other, there are different grades and qualities, just as there are different grades of crude oil. Higher grades of coal have an energy value of up to 12,600 Btu per pound; lower grades have only half or a third as much. One system of coal grading divides coal into two broad categories, hard and soft. The ability of coal to form coke also varies widely. Since a major use of coal is in steelmaking, a second classification divides coal into thermal or metallurgical grades.

Worldwide coal production in 1977 was 3400 million metric tons. The United States accounts for more than half of all the coal used by the noncommunist countries. The use of coal in the United States has been falling steadily except for electricity production, which now accounts for more than 75 percent of current production; the next largest use is in the steelmaking industry.

Coal reserves are of all types, and with adjustments made for the inferior energy of some soft coals, the reserves are sufficient to support 200 years' consumption at present rates. Expressed in terms of oil equivalent, these adjusted coal reserves are equivalent to the energy content of about 3000 billion barrels, which is four to five times the current estimates of proven world oil reserves. Expressed in another way, the United States' coal reserves are equal to about 150 percent of the world's current oil resources. These resources would enable the United States to regain energy independence if it so chooses.

Constraints on Coal Use

Although coal is the most abundant fossil fuel resource, it is also potentially the most damaging to the environment. In April 1971, the federal government set primary ambient air quality standards to safeguard public health against six air pollutants: sulfur dioxide, total suspended particulates, hydrocarbons, nitrogen dioxide, carbon monoxide, and total oxidants. Coal combustion emits three pollutants affecting these standards: particulates, nitrogen oxides, and sulfur oxides. The technology for control of particu-

lates is well advanced, and control systems provide high collection efficiencies with current fuels. Thus, meeting particulate emission standards is no problem for the future. The current retrofit technology for nitrogen oxide control is less advanced, and emission abatement systems are not yet available to reduce emissions to satisfactory levels. However, new coal-burning plants should be able to meet existing standards.[7]

the sulfur problem

A significant environmental problem is the emission of sulfur oxides. When mixed with water, sulfur oxides form sulfuric acid, a dangerous chemical that must be handled with extreme care. It is estimated that each year fossil fuel combustion releases 400 billion pounds of sulfuric acid into the environment. An acidic atmosphere is an obvious public health hazard, but the problem goes even further: acid attacks and corrodes metals. Thus bridges, outdoor stations, and other exposed structures are susceptible to acid deterioration. The resulting increased maintenance costs would be sizable.

Almost all this sulfuric acid falls as acid rain in the Northern Hemisphere. Acid rain runs off into the topsoil, leaching away calcium, a necessary plant nutrient. Studies have shown a definite decline in vegetative growth rate, both in Europe and in North America. An acidic water table can be detrimental to fish. In Norway and Sweden, which receive considerable acid rain, the rivers are becoming so acidic that commercial fish such as salmon and trout are ceasing to breed. In North America, fish kills have been reported in acidified lakes in Ontario, and in some parts of New Hampshire the rain is highly acidic.[8]

The principal means of combating current sulfur dioxide is by burning coal with low sulfur content. Unfortunately, most of the low-sulfur coal reserves in the United States are located west of the Mississippi River in the Rocky Mountain area, where transportation costs are significant. This coal is most easily removed by strip-mining, which is currently under strong attack by environmentalists. Thus, the possibilities for providing sufficient low-sulfur coal are opening new mines, desulfurization, and transportation of western coal to eastern markets.[9]

Desulfurization techniques available today are stack gas scrubbing, solvent refining, coal combustion processes, and precombustion sulfur removal. Several years ago it was assumed that stack gas-scrubbing systems would provide the least expensive method of sulfur dioxide emission control. These systems remove sulfur dioxide from flue gas and can be easily retrofitted to existing facilities. Although these systems have already been installed in several power-generating stations, their performance has been disappointing, and electric utilities are searching for other alternatives.[10]

The prospect of delays in the perfection of stack gas-scrubbing systems has increased interest in several alternative methods for precombustion removal of sulfur from coal rather than from effluent. Precombustion removal of sulfur from coal is probably more technologically feasible and cheaper than stack gas-scrubbing systems since the sulfur content of coal is more concentrated in the solid state than in gaseous form.

Currently, three processes are receiving attention in coal research and development programs: coal gasification, solvent refining, and coal liquefaction.

coal gasification

In addition to being a primary fuel, coal is a potential raw material for the production of synthetic gas and oil needed by major industry. In 1974 the Office of Coal Research provided a budget of $50 million for construction of three coal gasification pilot plants.

The idea of extracting gas from coal is far from new. There was a time when almost every city in the eastern half of the United States had a gashouse where town gas was produced for street and home lighting. The first American gas company was chartered in Baltimore in 1816, just four years after a gas company was established in London. By 1925 there were 150 international manufacturers of coal gasification equipment, and in the United States there were about 12,000 gasification plants in operation, consuming approximately 25 million tons of coal each year. However, virtually all of them disappeared with the availability of natural gas.

Today coal is still being gasified in Turkey, India, South Africa, Scotland, Morocco, Yugoslavia, and Korea.[11] However, the gas produced is of low Btu value but still environmentally acceptable. Low Btu gas derived from coal has several disadvantages. The conversion process might entail a loss of 25 percent in the original heating value of coal. Nor is it economically feasible to transport low Btu gas over long distances; therefore, the gasification plant must be located reasonably near the user. Finally, there is no method for storing large amounts of low Btu gas; thus fuel supply is very critical.

The major attraction of low Btu gasifica-

The nation has coal reserves in abundance, but the use of coal as a viable energy alternative to petroleum "will call for satisfactory solutions to the technical, economic, social, and environmental problems" involved therein.

tion is that it provides an ideal fuel for gas turbines in advanced combined-cycle power generators. In the combined cycle, stationary gas turbines are linked with steam turbines to yield a very high thermal efficiency. It is estimated that the combined system can compete economically with conventional fossil fuel plants equipped with gas stack scrubbers.

Existing technology for low Btu gasification of coal has served as a basis for efforts to develop gas of a high Btu content pipeline quality from coal. High Btu gas can be used as a substitute for natural gas and will be economical to transport over pipelines. In both high and low Btu coal gasification techniques, sulfur is transformed to hydrogen sulfide, which is easily removed by already commercially available methods.[12] However, in both gasification techniques (on an energy-equivalent basis), the cost would be $24 a barrel, or about twice the current price of a new, regulated interstate natural gas.

solvent refining

Solvent refining is a method of rendering high sulfur coal into an environmentally acceptable fuel at economical prices. In this process, coal is crushed, dissolved in a solvent, and then a purification stage removes the sulfur. The purified slurry can then be either dried into a low-sulfur coal or transported by slurry pipeline. Solvent refining of coal also allows for separation of coal conversion facilities and the final user, thus permitting flexibility in the location of these facilities.[13]

coal liquefaction

Coal liquefaction was pioneered by the Germans during World War II. Essentially, the process involves a chemical reaction of coal with hydrogen at high temperatures and pressures to yield a variety of products. Most liquefaction processes yield two or three barrels of syncrude for every ton of dry coal feed. For the United States, with its large coal reserves, the production of synthetic fuels from coal could be an attractive alternative to rising imports of oil and liquefied natural gas. The advantages of staying with liquid fuels are obvious: no great changes in technology are necessary by the consumer. The burden of investment is on the energy processors and producers. Today, $24 per barrel is the floor under the world price, with most exporters between $25 and $30 per barrel.

MANY conditions will have to be met before coal can again fill a growing share of the world's energy needs. Implicit are an awareness of the long-term energy outlook, policy decisions by governments to encourage both the production and use of coal, and public attitudes that make such policies feasible. Extensive facilities for mining, transporting, and burning coal must also be built. The construction of such facilities will call for a huge capital investment.

Individual national governments will have to decide the extent to which they will encourage or discourage the expansion of coal-consuming systems. Since long lead times are needed in shifting away from an energy system dominated by liquid fuel, decisions must be made soon if such a shift is to be made before oil becomes less and less available and even more costly than it is today. Choices made in the next few years will influence the energy industry for the next century.

For the United States coal is not a scarce resource. Thus the nation could possibly become an energy exporter. Exporting coal would have a positive effect on economic development, employment, and the balance of foreign trade payments.

If coal is to serve as a significant energy source, governments will soon have to adopt necessary policies to allow and encourage its

use. Both public and private investment decisions will be needed to provide funds for opening new extraction sites, building transportation facilities, and developing the infrastructure for handling and burning of coal by consumers. The expanded exploitation of coal will call for satisfactory solutions to the technical, economic, social, and environmental problems associated with the extraction and burning of coal.[14]

Grissom AFB, Indiana

We are grateful to the Alabama Environmental Quality Association for use of the accompanying photographs.

Notes

1. Robert H. Connery and Robert S. Gilmour, *The National Energy Problem* (Lexington, Massachusetts: Lexington Books, 1974), p. 76.
2. Joseph J. DiCerto, *The Electric Wishing Well* (New York: Macmillan, 1976), p. 2.
3. Ibid.
4. Ibid.
5. Edward D. Griffith and Alan W. Clarke, "World Coal Production," *Scientific American*, January 1979, p. 13; John Hagel III, *Alternative Energy Strategies: Constraints and Opportunities* (New York: Praeger, 1976), p. 27.
6. Connery and Gilmour, pp. 171-72.
7. Ibid.
8. DiCerto, p. 17.
9. Connery and Gilmour, p. 173.
10. Hagel, p. 32.
11. DiCerto, p. 13.
12. Hagel, pp. 31-33.
13. Hagel, p. 32.
14. Griffith and Clarke, p. 47.

Oil power is the power which stems from the dependence of the consumer nations on oil. This forms the basis of any successful application of the oil weapon and includes all factors which allow the producers to influence and control the political behavior of the consumers. The oil weapon, therefore, is one specific way of using oil power: other ways would be the threat to use the oil weapon, or simply the diplomatic exploitation of consumer dependence.

Hanns Maull

ENERGY, AMERICA, AND THE MILITARY

Can we get there from here?

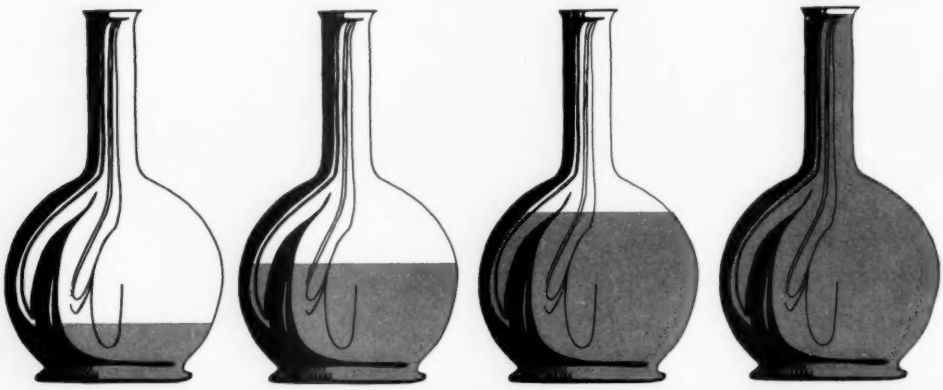
LIEUTENANT COLONEL JOSEPH A. BREEN

IF THERE are any near certainties in the complex world of energy and its potential impact on our society, this statement by Secretary of Defense Harold Brown is one of them:

> . . . there is no more serious threat to the long-term security of the United States and to its allies than that which stems from the growing deficiency of secure and assured energy resources.[1]

Current popular and scholarly articles often refer to the insidious nature of the energy problem and warn that the real danger lies in its becoming *critical* before the public even realizes it is serious.[2]

An illustrative analogy is that of a certain strain of bacteria with a doubling time of one minute. One bacterium is placed in a bottle at 11:00 A.M., and by noon the bottle is full. The essence of the illustration is in the last few minutes before noon. At 11:55 the bottle is 97 percent open space—little cause for even farsighted bacteria to worry about space exhaustion. At 11:58 the bottle is one-fourth full, and a massive effort is launched to acquire more living space. At 11:59, with the bottle half-full, three more bottles are located, and the bacteria supposedly breathe a collective sigh of relief since they have effectively quadrupled the original total space resource. At 12:00 noon the first bottle is full. At 12:01 the second is full. At 12:02 all four are full.[3]



The analogy is admittedly simplistic and the parallel to worldwide petroleum supply and demand obvious. Still, it contains a basic truth which Americans either have not yet recognized or, if they have recognized it, have yet to reach the point of demanding an accounting for the stewardship of their elected representatives.

Not that some hesitation is unwarranted. In this situation, as in many others, the relative inertia of the democratic process could conceivably prove a blessing since the passage of time often clarifies muddied issues. There are, however, indicators that time is running out. Long-term forecasting of energy supply/demand may not be particularly accurate, and intense popular pressure for immediate action could be less than productive when the options are obscured in a haze of technological, political, and economic uncertainties. However, the potentially unpleasant realities stemming from our laissez-faire approach to energy management would seem to demand immediate decisions and concurrent action.

Fortunately, the energy-related problems of the Department of Defense (DOD), and in particular the Air Force, are more clearly defined since the majority of our weapon systems are heavily dependent on liquid fuels for mobility operations. Assured access to these types of fuels is critical to our military effectiveness for at least the next twenty years and probably well beyond that. Defense energy issues, however, can be understood only in the context of the national energy situation.

The United States

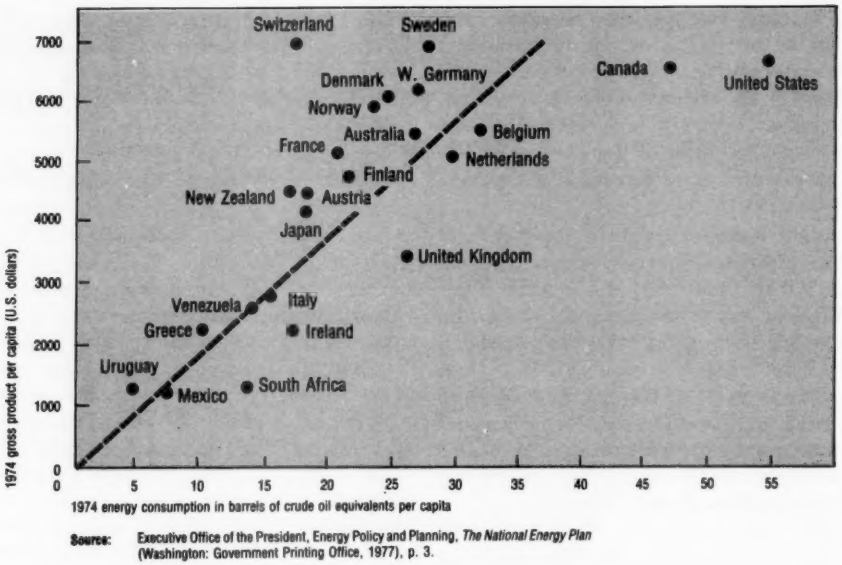
The United States energy situation affects all elements of society with growing concern and frustration. The nation's appetite for petroleum developed during a period of relatively cheap energy, the real price of which actually declined 28 percent during the fifties and sixties.[4] As replacement costs increased, public resistance to this reality, coupled with continuing government subsidies[5] (in one form or another), kept prices artificially low.

Today, the predicament in which the United States finds itself can be traced directly to that earlier era of artificially low-cost energy. The legacy of cheap energy testifies daily in both the quantity of capital goods in this country and the energy inefficiencies of our automobiles, homes, and manufacturing processes when compared to other members of the Organization for Economic Cooperation and Development (OECD).[6] Figure 1 illustrates the character of U.S. productivity per unit of energy consumed. Note that other nations, Sweden and Switzerland, for example, maintain similar standards of living with per capita energy consumption less than half that of the U.S. The size and diversity of the U.S. do not fully explain such consumption. Energy inefficiencies are major contributors.

Increased demand, decreasing reserves of domestic petroleum, and the dramatically rising price of imported crude have prompted the Carter administration to announce three overriding energy objectives:[7]

Immediate objective: to reduce dependence on foreign oil and vulnerability to supply interruptions. Given the average citizen's reluctance to adapt voluntarily to current energy realities, the domestic political climate, technical limitations, and the absence of any extreme international threat, one need not be gifted to visualize the difficulties inherent in achieving this objective in the foreseeable, much less immediate future!

Medium-term objective: to keep United States imports sufficiently low to weather the period when world oil production approaches its capacity limitations. Forecasts for this event vary from 1983 to the next century. Politically induced reductions in Iranian and Saudi Arabian production, not an irrational notion in light of events in these



Source: Executive Office of the President, Energy Policy and Planning, *The National Energy Plan* (Washington: Government Printing Office, 1977), p. 3.

Figure 1. Energy consumption per unit of gross national product

nations in 1978-80, could see the supply and demand curves meet as early as 1981.[8] The uncertainties here are understandable given the multiplicity of variables and the dramatic role any one of them could play. Demand itself pivots on an increasingly interdependent world economy. Supply, especially from the Organization of Petroleum Exporting Countries (OPEC), is subject to a host of political as well as economic equations.

Long-term objectives: to have renewable and essentially inexhaustible sources of energy for sustained economic growth.

The administration's objectives are set against an increasingly frustrating reality. Recent U.S. energy consumption has been about 38+ million barrels per day oil equivalent (mbdoe)[9] with domestic primary energy production reaching approximately 29+ mbdoe.[10] The majority of the daily energy shortfall of 9 mbdoe, a major source of U.S. economic and military concern, is made up by imported petroleum. (See Table I.)

Opportunities for appreciably increasing domestic crude production do not appear

Table I. U.S. net imports crude oil/products, 1977

	Bbl/day (thousands)	Percentage of Total U.S. Imports
OPEC	7,234	83
(OAPEC*	3,625)	(42)
Other	1,469	17
Total	8,703	100

*Organization of Arab Petroleum Exporting Countries

Source: CIA *Handbook of Economic Statistics 1978*, p. 88.

	1980	1985	1990
Optimistic	+17.7%	+34.4%	+37.5%*
Mean	+8%	+13.5%	+18.8%
Pessimistic	−1%	−1%	+5.2%

*Even the most optimistic long-term increase (37.5 percent) represents only 13.2 mbd total production. Current U.S. consumption is already nearly 20 mbd.

Note: Projections assumed decontrol of domestic oil production.

Source: Derived from U.S. Congress, Senate, Committee on Energy and Natural Resources, *Energy: An Uncertain Future*, No. 95–157 (Washington: Government Printing Office, 1978), p. 32.

Table II. Forecasts for increased domestic oil production (percentage increase over 1977 total domestic production)

promising. Twelve major oil firms provided data in response to a Congressional Research Service request for forecasts of domestic petroleum production to 1990. The best, average, and worse case forecasts for increased domestic production over 1977 production of 9.6 million barrels per day (mbd) are shown in Table II.

A comparison with demand projected during the same period reveals an even more serious shortfall between domestic supply and total requirements. A mean of 25 major studies produced between 1960 and 1975 and 15 studies developed from 1976 through 1978 shows the effect of current events, moods, and politics on long-range forecasts. (See Table III.)

The point is that current forecasts, even though considerably lower than earlier estimates, predict a significant increase in demand for decreasing conventional energy reserves. (Granted these forecasts are all subject to uncertain variables and what Franssen, in his recent analysis, refers to as *Zeitgeist* or the "spirit of the time.")[11]

Perhaps one encouraging aspect of the U.S. energy picture is that the energy-to-GNP ratio (illustrated in Figure 1) is being revised. In reality, the ratio (or multiplier) has varied considerably during the past quarter-century and has been favorably reduced during the 1970s.[12] In other words, continued real growth does not intrinsically require directly proportional increases in energy. However, reducing that ratio further will require higher efficiency in energy production, industrial processes, and methods of transportation.

Table III. Forecasts of U.S. energy demand

Date of Forecast	GNP Growth Rate (%)	Energy Demand Growth Rate (%)	Forecast Demand (Quads*) 1980	1985	1990
1960–75	3.49	3.61	89.8	110.7	130.8
1976–78	3.71	2.97	85.96	97.5	110.95
Percent Change	+6%	−18%	−4%	−12%	−15%

*One quad = 1 quadrillion (1×10^{15}) Btu or approximately 173 million barrels of oil.

Source: Derived from U.S. Congress, Senate, Committee on Energy and Natural Resources, *Energy: An Uncertain Future*, No. 95–157 (Washington: Government Printing Office, December 1978), p. 18.

Nearly half the current U.S. demand for energy is met by oil, and nearly half of that oil is imported. With present and predicted technology, domestic oil production, even under the most optimistic scenarios, will be little more than it is at present. Table IV, using an average derived from a cross section of major forecasts since 1975, reflects the impact of the 1973-74 embargo on the unrestrained optimism of earlier days; reduces bias to an acceptable minimum, it is hoped; and indicates the magnitude of the potential problem (i.e., increasing U.S. petroleum shortages and greater dependence on imports).

To place these figures in perspective, 9 million barrels per day (the *lowest* level of imports) is close to Saudi Arabia's total daily production, or double Iran's total daily exports before the Shah departed. Nine million barrels a day exceeds the Soviet Union's 1977 crude consumption and is more than 160 percent of Japan's crude consumption during the same period.[13]

Should the U.S. continue to function as a petroleum-based economy, either by default or conscious decision, what sources will be available to provide for demand beyond our domestic supplies?

Outside of OPEC, only Mexico has the potential for near-term (1980-85) excess capacity, and Mexico's oil prospects are another patchwork of uncertainties. Her proven reserves, oil and gas, have increased by a factor of seven in less than four years. Potential reserves may rival or even exceed those of Saudi Arabia. Official U.S. estimates of Mexico's productive capacity in the 1980s range from 4 to 10 million barrels per day, yet Mexican President Lopez Portillo has set a production target of only 2.25 mbd by the end of 1980 and is very sensitive to the inflationary potential of sharply increased production.[14] The higher U.S. figures may represent available petroleum resources but are almost certainly neglecting more important factors, not the least of which is North America's cavalier treatment of its proud southern neighbor. The United States is a natural, but not the only, market for Mexican hydrocarbons. Mexico has the technological know-how, and capital input from other members of the Organization for Economic Cooperation and Development would be a rational investment. In the future Japan alone may be purchasing "about 20% of Mexico's total production."[15]

Acutely aware of the problems associated with a booming oil economy, Mexico's ultimate production seems to depend more on what she perceives as a reasonable balance between recession and overheated development, rather than U.S. (or others') requirements. Though not a member of OPEC, Mexico will not sell her oil below market price unless there is a collapse of world demand. In fact, it may be sold well above the OPEC price. The advantages of relative physical security and shorter lines of supply would seem to be incentives for the U.S. to

Table IV. U.S. oil supply projections 1980-90 (millions of barrels per day)

	Domestic Production	Imported	Imports (percent of total)
1980	10.7	9.0	46%
1985	11.3	10.2	47%
1990	11.2	11.7	51%

Source: Derived from U.S. Congress, Senate, Committee on Energy and Natural Resources, *Energy: An Uncertain Future*, No. 95-157 (Washington: Government Printing Office, 1978), p. 21.

pay a premium for Mexican crude.

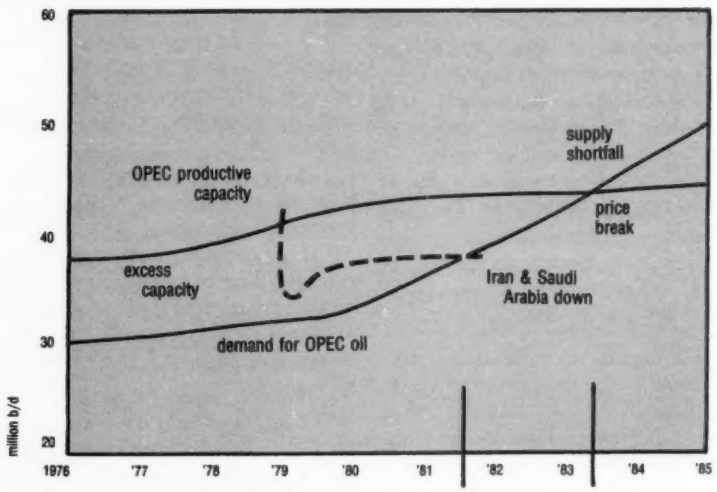
There is also the professed reluctance of Mexican authorities to flare gas in order to meet higher crude oil quotas. The U.S. is in a better position to take advantage of this gas, and it is far more economical to pipe across the border than to liquefy and export elsewhere. Again, the U.S. may be well advised to pay a premium for gas in order to encourage Mexican oil production.[16]

Mexican exports, while welcome, would satisfy only a small percentage of forecast U.S. petroleum requirements. Within OPEC, only Saudi Arabia seems to have reserve capacity to meet projected worldwide demand.[17]

The dotted line in Figure 2 represents an actual reduction in forecast capacity due to Iranian restrictions on crude production. (Iranian productive capacity was expected to begin declining in the early 1980s for geologic reasons, independent of political decisions.) The dotted line is also indicative of a Saudi political and technical decision to reduce production. The Saudi government reduced by 25 percent ARAMCO's plan to expand production to 16 mbd by 1983. Current target is 12 mbd by 1986, and the rationale, according to the Saudi authorities, is that the figure of 12 mbd in the mid-1980s will keep the world oil market in balance at constant or slowly rising real prices.[18] A series of technical, financial, and political factors, explained in a recent staff report to the Senate Subcommittee on International Economic Policy,[19] could keep Saudi production at the current range of 8-10 mbd for years.

For all practical purposes, the majority of the petroleum requirements of the U.S. that

Figure 2. OPEC oil: supply-demand gap



Sources: CIA, *The International Energy Situation: Outlook to 1985*, BR77-102400, April 1977. Ohio State University, *National Security, Mobility Fuels, and the Defense Production Act*, March 9, 1979.

cannot be met by domestic production may be available, if at all, only from a few primary sources. And these producers view U.S. requirements as only one of an extended series of complex and uncertain factors in the political process.

At best, the world's finite and dwindling petroleum resources may be considered as swing fuels, simply buying time to seek economically acceptable alternatives. Eventually, as fossil fuels become unacceptably expensive for energy production, renewable energy sources will predominate. Fossil fuels will then be available only for unique functions and raw materials.

Alternatives

The United States is blessed with a series of potential alternatives to imported petroleum. These alternatives could provide both the liquid fuels, for which our systems are designed and to which we have accustomed ourselves, and for energy sources which could provide heat and electricity thereby freeing petroleum for petrochemical feedstocks and essential mobility fuels. Once again, though, a number of uncertainties—price and availability of petroleum and natural gas, water requirements, environmental impact, social dislocation, vested interests, and public and bureaucratic inertia—combine to recertify the old caveat: There is no free lunch.

coal

Coal dominated U.S. energy production until World War II and today constitutes a majority of U.S. fossil fuel reserves. Commercial processes of varying efficiency now exist that convert coal to liquid or gaseous forms. Coal production compared to other fuels has been disproportionately slow in increasing, and these rises represent no real increase in the coal share of the energy market.[20] Increasing this share may be limited by various constraints: environmental, direct economic (demand, capital investment, transportation), and even technical; however, there are no reserve constraints. Known coal reserves are more than adequate for any likely degree of exploitation into the next century.[21]

A conscious political decision to substitute coal for oil in many sectors would seem to be a mandatory first step in the transition from oil. Federal incentives to support that decision would accelerate the process and continue an established precedent.[22]

A brief glance at eastern versus western coal supplies will serve to highlight a few of the technical and economic considerations influencing coal production. Only one-third of U.S. coal reserves, mainly western, are accessible to surface mining. Stripping, a relatively economical procedure, poses environmental problems. Western coal typically contains less energy (Btu) per ton than eastern or Appalachian coal. It is, however, low in sulfur, an environmental plus. Water, always an issue in the semiarid Southwest, is necessary for both production and land reclamation following strip mining and could be the deciding factor.[23] Technology can probably be relied on to provide a solution to ease the water, transportation, and energy transfer problem.[24]

U.S. *proven* resources of coal, 178,600 million metric tons,[25] have the thermal equivalent of nearly 800 billion barrels of oil—considerably more than current world reserves. This is more than enough to resolve our energy problem, but it took half a century to switch from coal to oil. Even the optimists do not give us until A.D. 2030 to change back to coal.

shale

Of U.S. oil shale deposits (with an estimated 2000 billion barrels of trapped oil) some 6 percent, or 120 billion barrels, are considered

commercially attractive.[26] This 6 percent is three times this country's current proven and probable petroleum reserves. Shale deposits around the world have been used for small-scale energy production (burning) for more than a century.[27]

U.S. government and private efforts to extract oil from shale have run an intermittent course since 1948, with several major problems consistently blocking attempts at commercial feasibility. Waste management, the disposal of enormous quantities of spent shale with its associated alkaline and (possibly) carcinogenic materials, and water for processing and environmental restoration lead the list of difficulties. Unfortunately, it is the water-scarce tri-border region of Utah, Wyoming, and Colorado that contains the richest and most promising shale oil reserves. Recent advances in modified in situ techniques of oil recovery hold promise for reducing problems in both waste management and water use. Surface waste disposal problems and materials handling are reduced by 85 percent, and the threat of leaching is appreciably reduced since surface waste materials are basic unprocessed shale.[28]

One would anticipate a reduction in water supply/disposal problems since water-oil ratios of 1.5:1 for conventional processing would be appreciably reduced by modified in situ production.[29] Threats to aquifers and surface water should also be reduced. Impressive as these improvements in shale oil production promise to be, large-scale commercial operations would still leave millions of tons of rubble to challenge the resourcefulness of the industry and enflame the environmentalists.

The prospect of rapidly rising costs for imported oil may make commercial extraction from shale feasible in the near future. However, since actual production costs for the OPEC exporters are a small fraction of the market price of oil, they are in a position to adjust crude costs to keep shale oil economically unattractive. From a national security point of view, the difference in shale and imported oil costs might have to be paid as the price for lowering dependence and switching to other energy sources.

Coal and shale oils offer the major alternatives to a petroleum economy during the transition period and into the indefinite future. U.S. tar sand deposits are small and not considered commercially exploitable, although Canadian deposits may eventually influence the U.S. economy. Energy sources, such as nuclear, and the less conventional solar resources (including hydro, wind, photovoltaics, bioconversion), and even geothermal are essential since they can replace petroleum in nonunique applications, e.g., heating and electrical power generation. Some are already available as supplementary mobility fuels. Gasohol, institutionalized in Brazil and now appearing in the United States, is an excellent example of bioconversion adapted for use in internal combustion engines.

nuclear

Nuclear power production has grown steadily during the past three decades, though it has not lived up to its advanced billing. Mid-'60s estimates for U.S. nuclear power capacity in 1980 average 150 gigawatts (Gwe), the energy equivalent of more than 4 million barrels of oil per day. Actual production in 1977 was 46.2 Gwe, or about 12 percent of U.S. electrical generation. As with other energy supply/demand forecasts, estimates produced since 1974 show more modest increases in future demand. (See Table V.)

Franssen's comprehensive study of world and U.S. energy projections lists some principal reasons for the lower estimates since 1975:

—Lower estimates of load requirements,
—Escalation of capital costs,

—Speed at which additional units can be licensed,

—Opposition by interest groups, especially environmentalists, and

—Opposition by state governments to plant siting and waste management.[30]

The 1980 forecast of 65.5 Gwe should be very close to actual capacity since these facilities are on-line or will be completed soon. (The Three Mile Island accident and the shutdown of five East Coast plants in early 1979 are not reflected in any of these figures.)

Emotion-charged public debates may be expected to continue on the issue of nuclear power. Improved safety procedures and systems will be a positive result balanced by increased costs to institute and maintain them. Increasing cost and scarcity of nuclear fuels are also major economic factors in the equation. Efforts to control fuel costs by reprocessing spent fuel and via breeder reactors are currently stalled by unresolved technical and political questions. Nuclear power will probably continue to grow since alternate forms of energy production, at least in the foreseeable future, also pose serious environmental and cost problems of their own.

Furthermore, countries less blessed with alternatives to petroleum and natural gas may view dependence on nuclear power as their only hope. The U.S. might find that international pressures to maintain an active nuclear program could have a major input on domestic programs. Our economic and military ties force us to be sensitive to allies' energy problems and see them as influencing our security. Within our capacity we must see them as our own. Added to this are the pressures of a nonproliferation policy that virtually assures our role, willingly or otherwise, as a major nuclear functionary.

Fusion power may seem such a shining hope simply because of its distance from present or known realities. Steady progress has been made on high-energy inputs to initiate the fusion process and on containment of the reaction, yet commercial demonstrations are not likely in the short- to medium-term. Its promise as a clean, nonpolluting, and virtually infinite source of power will, it is hoped, be fulfilled. At best, its real potential will probably not be realized until the twenty-first century.

hydropower

About 14 percent of the U.S. electrical energy demand is met by hydropower, mainly from the Pacific Northwest. Lack of suitable sites and environmental issues, not the least of which are aesthetic, will more than likely minimize large-scale hydro (and geothermal) expansion. Hydro increases in the near term will come mainly from increased generator efficiency and capacity at present sites. Current hydro input, about 1.5 mbdoe, is not projected to increase more than

Table V. U.S. nuclear electric capacity (Gwe)

Actual	Forecasts dated 1975–78		
1977	1980	1985	1990
46.2	65.5	132.4*	201.3

*1979 estimate of 113.0 Gwe appears more likely based on equipment operating or under construction at this time.

Source: Derived from CIA *Handbook of Economic Statistics 1978*, p. 95; and U.S. Congress, Senate, Committee on Energy and Natural Resources, *Energy: An Uncertain Future*, No. 95–157 (Washington: Government Printing Office, 1978), p. 21.

30 percent by the year 2000. The concept of dispersed, small-scale energy technologies (so-called low-head hydro turbines), reminiscent of New England's mill wheels, is an approach that seems to be gaining popularity. These systems, however, would contribute little to the national energy position by the year 2000, yet could potentially become an efficient supplement to irreplaceable fuels in many locations.

solar and other sources

Solar sources are extremely promising in the long term. The solar source may be harnessed directly for thermal processes (heating/cooling) or indirectly for production of electricity (wind, photovoltaics). The processes could be small and dispersed or even centralized in large space platforms, with energy channeled to earth via microwaves or lasers. Devices in several categories, for example thermal transfer and photovoltaic electrical generation, are already edging toward broader commercial acceptance. There are still unresolved technical/cost problems to overcome prior to large-scale introduction.

Here, again, uncertainties plague projections. A figure of 1.5-3.0 mbdoe by the mid-late 1980s[31] seems realistic, and that includes hydroelectric generation. Mainline (oil, gas, coal, nuclear) energy producers' fuel costs are highly unstable, thereby making estimates of competitive solar technology that much less predictable. Photovoltaic costs per watt are decreasing though other basic costs for labor and materials are increasing, further compounding the problems of true cost estimation. Also, backup and energy storage systems will be required for most solar schemes, thereby further obscuring true or comparative costs.

As the solar constituency in this country develops political visibility, further subsidies, direct (such as now written into our tax laws) and indirect (for example, space technology), will more than likely increase. The promise of efficient, renewable energy resources certainly warrants continuation of the established precedent that has provided over $200 billion in federal incentives for energy production, as shown in Table VI.[32] There is little doubt that solar energy application is an idea whose time has come.

conservation

The implications of conservation, though not technically an alternative energy source, are self-evident. This is especially true given the quantities and efficiency of energy use in the United States today. Roughly half of the energy generated in the United States provides no useful work, and in fact increases thermal pollution. The most flagrantly inefficient consumer of energy resources was, and still is, the transportation sector. Approximately 75 percent of the petroleum devoted to transportation provides no useful work, and 27 percent of all U.S. energy is consumed by transportation. Half of this, about five million barrels per day, is consumed by automobiles. Opportunities for conservation in other sectors are not so dramatic, but these are definitely valid opportunities for stretching overall resources.[33]

Table VI. Estimated cost incentives to stimulate energy production, 1918-77

	(billions in 1977 dollars)	(percent of total)
nuclear	18.0	8.3%
hydro	15.33	7.0%
coal	9.71	4.5%
oil	101.3	46.6%
gas	16.50	7.6%
electricity	56.58	26.0%
Total	**217.42**	**100.00%**

Conservation, in effect, provides increased energy supplies and, like other sources, is not without problems of its own. In addition to requirements for capital investments, government must walk a narrow line between reducing demand by increased efficiencies and simply depressing economic activities. Consumption is reduced by both, but many undesirable effects accrue to the latter.

Continued government incentives, such as the current tax relief for investment in insulation, encourage conservation with less impact on economic activity. European practices and technology, such as cogeneration, offer further opportunities to reduce the energy-to-output ratio of our industries. Potentially traumatic changes in traditional life-styles and expectations hold many unanswered questions for the political fabric of our society. An important element in our ability to control these stresses shifts from domestic to foreign political figures as our dependence on imported oil increases.

Energy and the Military

It is this diminishing control over the most basic ingredient in the U.S. economy that could conceivably result in extensive demands on the military element of our national power. Yet here, again, is another dilemma. The armed forces, especially the Air Force and Navy, are more reliant on petroleum derivatives than almost any element of our society and therefore highly vulnerable to shortfalls. Ironically, that element of our national power which may be called on to ensure energy security for the U.S. or its allies could be severely constrained by a lack of energy, specifically mobility fuels—virtually *all* derived from petroleum.

I suggest it is not only the abrupt cutoff of OPEC crude that poses the greatest threat to the military element but also the steady increase in price and potentially misdirected efforts at economy. Those in the military are quite familiar with the emphasis on "doing more with less." This emphasis on improved management has introduced changes and in many instances clearly forced efficiencies where few existed before. However, under peacetime conditions, as price and shortage pressures increase, there is the temptation to reduce flying hours and steaming days beyond an as yet undetermined point where combat capability is curtailed. Reductions affect not only the combat skills of the operational crews but the supply and maintenance systems that support them. Without flexibility in these vital systems, combat effectiveness is drastically reduced. These pressures can be expected to increase. "Simulation" and "more efficient use of currently allocated resources," both excellent approaches to the problem, must be carefully and realistically applied and evaluated lest dedicated (and anxious to succeed) decision-makers (at any level) accept degraded combat capabilities. Most commanders are familiar with the pressures implied by this situation.

In an abrupt, cutoff scenario, there is little doubt that petroleum would be allocated from domestic sources to meet the military's needs. It is under a less traumatic scenario, such as we face today with the fuel price/availability squeeze, that the services are most susceptible to petroleum anemia. The military, dependent on petroleum-type mobility fuels through the rest of this century, faces possibly debilitating pressures. They are dependent on the policy action of civilian agencies to provide alternative fuels, and there has already been criticism of the lack of national defense consideration in planning and policymaking.[34]

The impact of DOD energy requirements may seem deceptively small since peacetime demands draw only 2-3 percent of the nation's energy. A more realistic appraisal would consider defense-related industries consuming an equal amount and DOD de-

mands tripling under emergency conditions, with some 90 percent of the military's demands specifically for petroleum-based mobility fuels. The Department of Defense is already the largest single energy consumer in the United States.[35]

A shutoff of overseas sources would make critical demands on our allocation and distribution systems. Nearly one quarter of DOD's petroleum supplies (almost 39 million barrels per year) is purchased overseas, and half of this is jet fuel.[36] An emergency means not only deriving fuels from domestic sources but transporting them to overseas locations. Under a minimum-import emergency condition, Air Force aviation fuel requirements alone could require access to nearly 22 percent of *all* U.S. domestic crude production.[37]

The impact of 1979's crude shortages and unexpected price increases on the international market will undoubtedly put pressure on domestic allocations. Every cent-a-gallon increase in aviation fuel adds $36 million to the U.S. Air Force fuel budget—the approximate flyaway cost of five F-16 fighters. It is not difficult to understand the pressures that can be anticipated to cut beyond "fat" and into the operational readiness of our armed forces.

A report prepared for the House Subcommittee on Economic Stabilization illustrated the potentially decisive role petroleum plays in our defense posture, as seen in Table VII.

A conclusion of that report commented: ". . . augmented domestic oil production, limited as it may be by geologic realities, and supplementary mobility fuels from alternative sources, are now critical in terms of national defense."[38]

In late 1978 a recommendation within the Department of Defense called for development of a comprehensive Defense Mobility Fuels Action Plan. It emphasized the following:[39]

—DOD/DOE cooperation to meet defense mobility fuel requirements through commercial development of synthetic fuel.

—Technical and operational plans required for a post-1985 transition to synthetic fuels. This includes ensuring that DOD's systems are capable of using both synthetic and conventional fuels.[40]

—Developing the industrial base to implement capability to use synthetic fuels.

The Army, Navy, and Air Force are currently developing a capability to use synthetic fuels in their respective systems.[41]

It is the Department of Energy that must face the major issue, and that is developing

Table VII. Percentiles of the energy budget by war categories

Type of War	Percent of National Energy Budget	Percent of National Oil Budget
A "Vietnam" without interruptions to oil imports	3	6.5
A "WWII" without interruptions to oil imports	4.6	9.5
Another Arab embargo	7.7	17.5
An Arab embargo with military reaction on a "Vietnam" scale	10.9	23.9
A "WWII" with 90 percent of oil imports blockaded	21.7	49.2

Source: Ohio State University Energy and National Security Project, *National Security, Mobility Fuels, and the Defense Production Act*, March 9, 1979, p. 22.

programs and incentive proposals to ensure that commercial quantities of synthetic fuels are available to DOD (and other) customers. The United States cannot afford to allow the lack of a single, clearly superior alternative to continually delay efforts to ensure secure supplies of mobility fuels for defense. The Deputy Under Secretary of Defense for Research and Advanced Technology, in supporting a careful assessment of available options, warned that ". . . in our pursuit of careful studies and objective assessments we must not, by virtue of our *failure to take decisive actions,* foreclose on our ability to protect our national security."[42]

FROM the foregoing, one could conclude that there are no shortages of potential energy resources. There does seem to be a shortage of certainties or political decisions on which paths to follow to reduce our present vulnerability to external economic or political decisions inimical to our interests . . . and a shortage of time in which to do it. The lead time required to implement our decisions has already reached the point where U.S. energy vulnerability will continue increasing for years before the process can be reversed. The lack of one, or even a few, clearly superior alternatives seems to have hamstrung our ability to act decisively on one of the most serious problems of our time. The uncertainties within the question and the multiplicity of partially effective answers have frustrated decision-makers and the populace and eluded America's traditional penchant for identifying a problem, channeling resources toward its resolution, and solving it in a short period of time. To a degree, this ambiguity and resultant frustration may explain why the public and the bureaucracy have avoided the issue to the point where now it may well become "critical before we know it is serious." There seems to be no comfort for the American technological "quick-fix" approach in problems of this nature.

In summary, it appears that relief will come only through a broad series of technical and political advances that include incentives, conservation, and multiple alternate energy sources. The question is, when will decisions be made that will reverse the trend, and what stresses, domestic and international, will this nation be subjected to in the interim?

There is no shortage of energy "bottles" that will offer relief from our present, increasingly precarious position. There is, however, an acute shortage of willingness, or ability, to make decisions on one of the most critical issues of our time. There is one certainty—delaying that decision brings us that much closer to high noon.

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Notes

1. U.S., Congress, House, *The National Energy Plan: Options under Assumptions of National Security Threat,* Hearings before the Ad Hoc Committee on Energy, U.S. House of Representatives, 95th Congress, 1st session, on the National Energy Act of 4 May 1977, 95th Congress, 1st session, April 1978, p. 28.

2. Carroll L. Wilson, *Energy: Global Prospects 1985-2000* (New York: McGraw-Hill, 1977), p. 16. Wilson is Project Director, Workshop on Alternative Energy Strategies.

3. Albert A. Bartlett, "Forgotten Fundamentals of the Energy Crisis," *American Journal of Physics,* September 1978, pp. 877-78.

4. Executive Office of the President, Energy Policy and Planning, *The National Energy Plan,* April 1977 (Washington: Government Printing Office, 1977), p. vii.

5. For example, cost incentives to stimulate oil production in the United States have been estimated at over $1 billion. Battelle Pacific Northwest Laboratories, *An Analysis of Federal Incentives to Stimulate Energy Production,* Executive Summary, December 1978, p. 7.

6. Executive Office of the President, *The National Energy Plan,* April 1977, p. 3.

7. Ibid., p. ix.

8. Howard Bucknell III, Robert Bailey, Norman Rask, *National Security, Mobility Fuels, and the Defense Production Act,* Report for the

Subcommittee on Economic Stabilization of the House Committee on Banking, Finance, and Urban Affairs, Congress of the United States, 9 March 1979, p. 8.

9. Exxon Company, *Energy Outlook 1978-1990* (Houston: Public Affairs Department, May 1978), p. 4.

10. CIA Report, *Handbook of Economic Statistics 1978*, ER 78-10365, October 1978.

11. Simply stated, the effect of the zeitgeist is for forecasters to project future energy requirements higher when the analysis takes place during a boom and vice versa. Dr. Herman T. Franssen has written a report analyzing the major national and international forecasts of energy supply and demand. U.S., Congress, Senate, *Energy: An Uncertain Future*, prepared at the request of the Committee on Energy and Natural Resources, Publication No. 95-157 (Washington: Government Printing Office, December 1978), pp. 5-6.

12. Ibid., pp. 17, 18.

13. CIA Report, *International Energy Statistical Review*, ER 1CSR 79-003, 7 March 1979.

14. "Mexico's Reluctant Oil Boom," *Business Week*, January 15, 1979, p. 64.

15. "New Japanese-Mexican Oil Deal Almost Certain," *Energy Daily*, January 16, 1979, p. 3.

16. John Dillin, "Natural Gas: U.S.-Mexican Impasse," *Christian Science Monitor*, January 10, 1979, p. 1.

17. CIA Report, *The International Energy Situation: Outlook to 1985*, ER 77-10240 U, April 1977, pp. 2, 18.

18. Ted H. Moran, "OPEC and the World Oil Market," *Resources for the Future*, January-March 1979, p. 7.

19. U.S., Congress, Senate, Committee on Foreign Relations, *The Future of Saudi Arabian Oil Production*, Staff Report to the Subcommittee on International Economic Policy, 96th Congress, 1st session, April 1979.

20. Executive Office of the President, *The National Energy Plan*, April 1977, p. 63.

21. Edward D. Griffith and Alan W. Clarke, "World Coal Production," *Scientific American*, January 1979, p. 40.

22. The coal industry has received approximately 4.5 percent of the total federal energy incentive package, some $9.71 billion. This compared with the oil industry's $101.3 billion, or 47 percent of the incentive package. Battelle Pacific Northwest Laboratories, *An Analysis of Federal Incentives to Stimulate Energy Production*, Executive Summary, December 1978, p. 7.

23. Griffith and Clarke, p. 43.

24. A consortium of "powerful financiers and former government officials" has proposed converting low-sulfur western coal into methanol (alcohol) and using this as the medium for a coal slurry. See "A Coal Slurry Idea May Save Water," *Business Week*, January 15, 1979, p. 39.

25. CIA Report, *Handbook of Economic Statistics 1978*, p. 84.

26. Wilson, p. 220.

27. Oil shale was mined in Scotland from 1860 to the mid-1900s; Estonia mines 25 million tons a year, half of which is burned at the mine to produce electricity. William D. Metz, "Oil Shale: A Huge Resource of Low-Grade Fuel," in "Energy: Use, Conservation and Supply," *Science* compendium, Philip H. Abelson, ed. (1974), p. 70.

28. Bucknell et al., p. A-6.

29. Wilson, p. 220.

30. Franssen, p. 35.

31. Ibid.

32. See Battelle Laboratories, *An Analysis of Federal Incentives to Stimulate Energy Production*, p. 7.

33. U.S. Energy Research and Development Administration, *Energy Flow Patterns for 1975*, R. B. Kidman, R. J. Barrett, D. R. Koenig, Los Alamos Scientific Laboratories (Washington: Government Printing Office, June 1977), p. 72.

34. William D. Wiard, *Energy Section, Systems Acquisition Strategy Study*, Andrews Air Force Base, Maryland: Hq Air Force Systems Command, October 1977.

35. Ruth M. Davis, Deputy Under Secretary of Defense for Research and Advanced Technology, *Defense Mobility Fuels*, Statement before the Subcommittee on Economic Stabilization, Committee on Banking, Finance and Urban Affairs, 96th Congress, 1st session, March 13, 1979.

36. U.S., Congress, House, *The National Energy Plan: Options under Assumptions of National Security Threat*, A report for use by the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce, 95th Congress, 2d session, April 1978, p. 43.

37. In 1977, U.S. primary crude production was 8.18 mbd (CIA *International Energy Statistical Review*, March 1979); USAF aviation fuel consumption during the same period, 238,356 bbl/day (USAF Summary, March 1979); USAF consumption x 3 (wartime conditions) equals 715,068 bbl/day. Since approximately 40 percent of each barrel of crude yields aviation fuel, 715,068÷.40 = 1,787,670 barrels per day, or 21.9 percent of the total 8.18 mbd. Adding the Navy's aviation fuel requirements brings this to 30 percent. Of course, the remaining products, 60 percent of each barrel, would be available for other purposes. Reduced domestic production in the future would mean a proportional *increase* in the percentage of crude required.

38. Bucknell et al., p. 23.

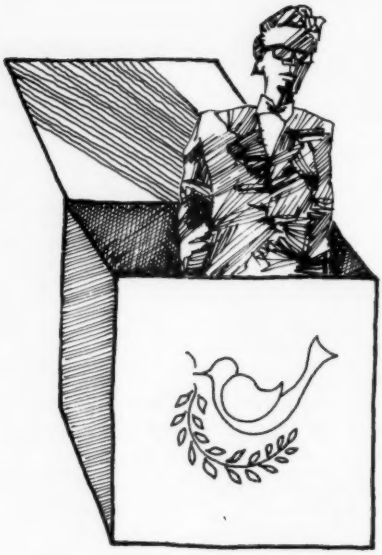
39. Davis, pp. 6, 7.

40. To date, coal-based synthetic fuels require efforts to improve low-hydrogen characteristics. Problems include smoke, combuster liner temperatures, infrared signature, and poor thermal stability. (William L. Stanley, "Future Sources of Military Jet Fuels," Rand Corporation P-6099, May 1978, p. 6.) Shale synthetic fuel meets most current standards, but has been high in particulate matter and gum and shows poor storage and thermal stability characteristics. (Gebman et al., "The Potential Role of Technological Modifications and Alternative Fuels in Alleviating Air Force Energy Problems," Rand Corporation R-1829-PR, December 1976, p. 51.) These problems can be overcome with current technology and further development.

41. See the Army, Navy, and Air Force Energy Plans for a detailed outline of service plans/programs on all aspects of energy management. *Army Energy Plan* (24 February 1978) prepared by Unified Industries, Inc., Alexandria, Virginia. *Navy Energy Plan* (OPNAV Document No. 41P4, 27 July 1978) and *Air Force Energy Plan* (July 1978), both prepared by Tetra Tech., Inc., Arlington, Virginia.

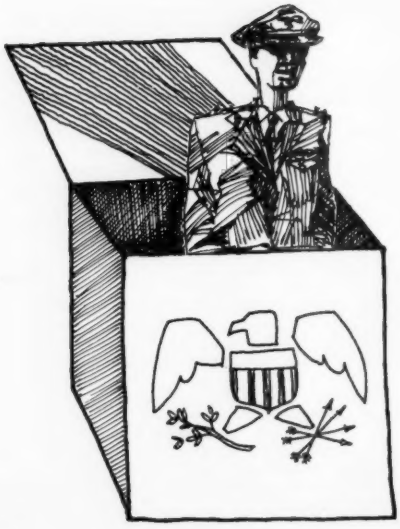
42. Davis, p. 9. Emphasis added.

"... color the civilian crate peaceful and the military one martial."



CIVILIAN CONTROL OF THE MILITARY IN SOUTHEAST ASIA

COLONEL JOHN SCHLIGHT



SERIOUS scholarly analysis of the question of civilian control of the military has traditionally been the preserve of the social scientists, usually political scientists and sociologists. In an attempt to make their subject more manageable and reduce a plethora of data to digestible proportions, these scholars tend to rely on several assumptions. Foremost among these is their use of institutional and organizational categories to define what they mean by *civilian* and *military*. For the civilian part of the equation, they rely heavily on organizational charts peopled with individuals in mufti, while for the military they look to uniform-clad bureaucrats. We are told, for example, that during World War II President Roosevelt turned the conduct of the war over to the military strategists.

Or we hear that during the conflict in Southeast Asia President Johnson personally chose the targets to be struck in North Vietnam, or that at one time he even called a jet fighter pilot in midair to give him instructions. Examples like this suggest a clearer dichotomy between military and civilian than can usually be supported by the evidence. While such dramatic instances may have a ring of truth, their uncritical acceptance and repetition reinforce the idea of a rigid organizational distinction between two self-contained groups.

A corollary to this tendency to place civilians in one box and the military in another is to color the civilian crate peaceful and the military one martial. That care must be exercised in accepting such coloration has been amply demonstrated by Richard Betts,[1] who shows that the more warlike utterances and the decisions most likely to have led to military confrontation during the Cold War emanated from civilians; while the military, more attuned to martial realities, often provided the voice of moderation.

A second pervasive assumption, drawn like the first from organizational charts, is that the only type of control to be discussed is that of the formal, bureaucratic authority enjoyed by a superior over a subordinate. In the military, for example, this form of control is exercised through the chain of command, which runs from the President through the defense secretary, military chiefs, commanders, and on down. Also, too often implied in this rigid view of control is the assumption that decisions, once made at the planning level, are brought to unaltered fruition on the field of battle by soldiers, sailors, and airmen responding automatically to perfectly understood guidance from above. Examination of the details also weakens this assumption. Leaving aside the handful of dramatic instances where it could be reasonably argued that the military set out intentionally to pursue national policy by means somewhat at variance with those envisioned in Washington, the slippage between planning and implementation is often the natural consequence of differing perceptions and of a more intimate, practical appreciation by the military of the capabilities and probable results of their technology. Analysts of civilian control would disregard this frequent and practical disconnect between theory and practice at their own risk.

How much would the traditional picture of civilian control of the military change if these assumptions were discarded and replaced with others? What conclusions would emerge, for example, if *civilian* were redefined not along the lines of habiliment but as a mind-set encompassing political, economic, psychological, and social factors? How many of those who in present analyses inhabit the military cubbyhole would be moved over into the civilian box? And again, what would be the outcome if, instead of looking at job descriptions of individuals to discover the locus of control, emphasis were placed on the ideas that control events, without concern for the garb of those who generate the ideas? How many of those now classified as *civilians* would emerge, while retaining their Brooks Brothers cover, as *military?*

A close examination of the air war in Southeast Asia suggests that there was a surprising degree of role changing. The traditional distinction between military and civilian often broke down, due at least in part to the nature of the conflict. Uniformed people were involved in pacification programs, monitoring economies, and dealing directly with Vietnamese province chiefs, who themselves combined military and civilian functions. Conversely, one phase of the conflict in northern Laos was the responsibility of civilians in the embassy at Vientiane. Such a crossover of roles undermines the traditional and comfortable distinction between civilian and military. As a consequence, it bends to

the breaking point the formerly accepted lines of control and forces us to look to specific cases to obtain even a glimmer of who controlled whom and, even more important, what were the controlling ideas. To expect a neat generalization about civilian control of the military is more than can be hoped for.

The United States Air Force fought four wars simultaneously in Southeast Asia between 1965 and the end of 1972: a bombing war against North Vietnam in concert with the Navy and, on occasion, with the South Vietnamese Air Force; a war in northern Laos both against North Vietnamese supplies flowing to the Communist Pathet Lao and in direct support of Meo tribesmen and Laotian ground troops engaged with the Communists; an interdiction campaign against the Ho Chi Minh Trail in the Laotian panhandle, again with the Navy's assistance; and a war in South Vietnam itself in support of American and South Vietnamese ground forces. Each of these wars had its own objectives and methods for achieving them, and each was pursued in a command and control environment that differed in many ways from the others.

The United States Air Force fought four wars simultaneously in Southeast Asia . . .

The "organizational chart" for control in each of these wars was set up by presidential directive in March 1966. According to this arrangement, the Joint Chiefs of Staff (JCS) and the National Security Council were directly responsible for the bombing campaign against North Vietnam. Since both of these groups were presidential advisers, this meant that President Johnson intended to keep close personal supervision of these operations. The ambassador in Vientiane was given control over the wars in Laos, both north and south. Control of the action in South Vietnam was delegated to the military commander in Saigon, General William C. Westmoreland. This is the way it was on paper, but it did not always unfold that way in reality.

North Vietnam

The bombing raids against the north, being the most dramatic and politically sensitive of the four wars, were monitored closely by Washington and are most frequently cited as an illustration of civilian control of the military. Despite the fact that this was the war the Air Force favored from the start and continued to espouse throughout the conflict, its shape when it began early in 1965 was molded by the political desire to impress Hanoi with America's firmness and to boost the sagging morale of the South Vietnamese. Even the so-called military aspect of this objective (that is, to increase the cost to the north of continuing its support of the Vietcong) was only partially military. Given the political and diplomatic equity that the American government had in the bombing, it was almost foreordained that the campaign would be gradual and an almost half-hearted attempt designed more as a diplomatic calling card than as a serious attempt to halt the enemy militarily.

It is fashionable to illustrate the absolute nature of civilian control over the bombing campaign by quoting President Johnson's alleged boast that the military "can't even bomb an outhouse without my approval."[2] It is undeniable that the organizational charts endowed the chief executive with this degree of control. But a closer look at the genesis and subsequent maturation of the bombing campaign suggests that military ideas were not as dormant as that remark might imply.

During the planning for the first bombing

campaign, Rolling Thunder, there was much discussion of what it was expected to accomplish and how it should be conducted. The President's civilian advisers viewed the bombing as a psychological weapon whose value lay not so much in the physical damage it would inflict as in the threat it would pose to the North Vietnamese of greater pressure to come if they did not halt their aid to the southern insurgents. Many military leaders, on the other hand, argued strongly and consistently for rapid, full-scaled strikes against military rather than psychological targets. The Joint Chiefs wanted to blitz airfields that sheltered MiG jet fighters, railroads that brought aid from China, petroleum storage areas that kept the military going, and the main roads through which reinforcements passed from north to south.[3] The difference, in short, was between whether the real target of bombing should be the will or the capability of the North Vietnamese to continue their aggression in the south.[4]

For the first few weeks targets were chosen primarily for their supposed political and psychological value.

Rolling Thunder got under way early in March 1965 with the dispute unresolved. For the first few weeks targets were chosen primarily for their supposed political and psychological value. The stated objectives of the campaign were, in order of importance, to boost morale in the south, to show the north that the United States meant what it said, and to show that it could inflict pain on the north.[5] The military criteria of inflicting physical damage and stopping or slowing the flood of reinforcements played little part. "Our primary objective," according to Secretary of Defense Robert McNamara, "was to communicate our political resolve."[6]

But this soon changed when it became apparent that the will of the north remained undaunted by the bombs. Exactly one month after the opening of the campaign, the rationale began to shift closer to the military one. By April the bombing was officially pictured as an attempt to interrupt the infiltration of men and materiel from north to south. The new targets reflected this military rationale. Air strikes were now aimed at transit points, barracks, supply depots, ammunition depots, and communication routes including railroads, highways, and bridges. At this point McNamara told the press:

> Now the current strikes against North Vietnam have been designed to impede this infiltration of men and materiel, an infiltration which makes the difference between a situation which is manageable and one which is not manageable internally by the government of South Vietnam. The air strikes have been carefully limited to military targets, primarily to infiltration targets.[7]

The metamorphosis of objectives was complete two years later when McNamara told Congress that:

> Our primary objective was to reduce the flow and/or to increase the cost of the continued infiltration of men and supplies from North to South Vietnam.
>
> It was also anticipated that these air operations would raise the morale of the South Vietnamese people who, at the time the bombing started, were under severe military pressure.
>
> Finally, we hoped to make clear to the North Vietnamese leadership that so long as they continued their aggression against the south they would have to pay the price in the north.[8]

The enemy's capability had replaced his will as the object of attack.

The Rolling Thunder campaign lasted more than three years before President Johnson stopped it on 1 November 1968. During this time, target lists were gradually expanded and oriented in the direction originally sought by the Joint Chiefs. In addi-

tion to hitting preselected targets, airmen were permitted to fly armed reconnaissance missions in which they could strike targets of opportunity not specifically designated by Washington. Early in 1966, the boundaries of these armed reconnaissance areas were increased, although 30-mile rings were drawn around Hanoi and Haiphong, the north's two major cities, which remained off limits to the bombers. In June the administration approved strikes against seven major petroleum depots within these rings, and in December the rings were reduced to ten miles. In 1967 some exemptions were given for striking particular targets even within these rings. In August of that year, further relaxation of restrictions allowed the attack planes to bomb 52 of 57 targets that previously had been proscribed.[9]

Each step in this gradual addition of targets was the result of a compromise between the political and military pressures at work on the President. The military pressures were not always voiced by people in uniform. From the outset the American ambassador in Saigon, Maxwell Taylor, deplored the piecemeal application and urged expanded bombing.[10] The CIA director, John A. McCone, was even more emphatic:

> We must also change the ground rules of the strikes against North Vietnam. We must hit them harder, more frequently, and inflict greater damage. Instead of avoiding the Migs we must go in and take them out. A bridge here and there will not do the job. We must strike their airfields, their petroleum resources, power stations and their military compounds. This, in my opinion, must be done promptly and with minimum restraint.[11]

But the strongest "military" tones came from a different civilian quarter, the United States Senate. Following a review of the first two years of the campaign, the Preparedness Subcommittee in August 1967 strongly urged that the military voice be listened to. As a result, the bombing increased. Shortly thereafter Secretary McNamara resigned.[12]

Viewed solely from the aspect of targeting, military inputs seem to have carried at least as much weight as civilian ones in determining the shape of Rolling Thunder. Even by the traditional bureaucratic definition of civilian control, there was a slight relaxation of civilian oversight as time passed, due mainly to the administration's disappointment with the initial results and relative downgrading of the bombing campaign when American troops began pouring into the south in late 1965. From the targeting point of view, therefore, it is an oversimplification to speak unqualifiedly of civilian control of the military.

The enemy's capability had replaced his will as the object of attack.

But while the influence of civilian ideas on targeting was gradually watered down during Rolling Thunder, it never wavered on the second of the Joint Chiefs' demands, namely, that the bombing be quick and full scale. From the outset the Chiefs wanted to catch the enemy off guard and not give him time to recover and regroup. In their view, the advantages of hitting targets, even the right ones, would be lost if the job were not done quickly. But the job was not done quickly. Because each increase in the bombing campaign resulted from a compromise, it ended up being three years of gradualism rather than decisive escalation. The bombers were called off 8 times between 1965 and 1968, once for 37 days, in hopes that the North Vietnamese would negotiate. Instead they replenished themselves. Looked at from the aspect of pace, civilian control of the campaign remained predominant.

For a year and a half after the bombing halt of 1 November 1968, the skies over North Vietnam remained relatively quiet. American planes continued to fly reconnaissance missions below the 19th parallel, and they were permitted to strike back at antiaircraft guns that fired at them. Throughout all of 1969 only 285 attacks were made against antiaircraft guns in the north, compared with 105,700 sorties against a wide variety of targets two years earlier at the height of the campaign.[13]

The decision to continue the bombing halt through 1969 had a military as well as a civilian foundation. Richard Nixon's assumption of the presidency early in 1969 provided an excellent opportunity, had he wanted it, to end the bombing halt and resume Rolling Thunder. But military logic was by now dictating otherwise, and the bombers were carrying out the same mission elsewhere: on the Ho Chi Minh Trail in the Laotian panhandle, where full-scale interdiction campaigns were under way. It was a military judgment that this was a more fruitful area in which to slow down enemy infiltration than north of the demilitarized zone.

From the outset the Chiefs wanted to catch the enemy off guard and not give him time to recover and regroup.

Throughout 1970 and into 1971, American planes met increasing resistance over North Vietnam in the form of more sophisticated antiaircraft systems and stepped-up use of MiG fighters by the enemy. Slowly the rules were relaxed to permit attacks on the defenses up to the 20th parallel and as soon as enemy radars locked on to the attacking planes; American bombers no longer had to wait until fired on to attack. It was the air commander's (General John D. Lavelle) liberal interpretation of this latter rule that led to his replacement early in 1972. The meekness of the American response in the north allowed a massive North Vietnamese buildup of forces, and in April 1972 they poured across the demilitarized zone in a murderous attack on the south.

The American air response to this invasion constituted the second campaign against the north, called Linebacker. Most of the restrictions were removed as American planes struck targets throughout North Vietnam up to within 30 miles of the Chinese border. Ten-mile rings around Hanoi and Haiphong were reinstated, within which planes could not strike without specific authorization. But the targets were military, and the pace was swift. For the first time in the war, U.S. planes mined North Vietnamese harbors, particularly that of Haiphong, which was the major entry point for materials from the Soviet Union. These American actions were based solely on the military need to stem the enemy's invasion. Civilian control, in the sense of civilian ideas as motivating factors, were secondary. The Linebacker campaign (April-October) was aimed primarily at the enemy's capability and only tangentially at his will. During the eight months of the campaign, U.S. aircraft flew more than 41,500 sorties over the north,[14] and the invasion ground to a halt. This was a military campaign, pure and simple.

The final air action against the north took place at Christmastime 1972, when Hanoi appeared to be stalling on peace negotiations. The campaign, called Linebacker II, had as its stated objective persuading the leaders in Hanoi that they would be better off coming to terms. For eleven days beginning on 19 December, almost 2000 sorties flew against targets in the Hanoi and Haiphong areas.

The bombing stopped on 29 December, and three days later negotiations resumed. The extent to which Linebacker II forced the north to return to the negotiations is still a matter of dispute. What is beyond question, however, is that one purpose of the air campaign was to get the enemy back to the conference table, and, even though the targets were military and the pace swift, civilian goals controlled the attacks. More clearly perhaps than in any of the four air wars, and even more than in earlier campaigns in the war over the north, air power was being used for and controlled by civilian purposes.

In sum, the eight years of air activity over North Vietnam remained largely under civilian control, even when that control is defined as a set of ideas rather than as a group of people in civilian clothing. But even here the picture of civilian control is not as absolute as is often suggested. During a few periods, particularly in 1972, military control in the sense of targeting and pace predominated.

While Seventh Air Force had the planes, however, it had little say in how they would be used.

Northern Laos

To the west of North Vietnam lay Laos, one of the three states that earlier had formed the defunct French Indochina and one in which the North Vietnamese had historically been strong, especially in the two northeastern provinces which abutted North Vietnam. North Vietnamese assistance to the local Communists, the Pathet Lao, continued throughout the war. Since an agreement in 1962 limited the number of outside military personnel allowed in the country, responsibility for the American effort to support the Laotian government was given to the U.S. ambassador in the capital, Vientiane. A glance at the organizational chart would suggest clear civilian control of operations. Would a closer look at the air action confirm or change this conclusion?

Of the four air wars, the one in northern Laos (called Barrel Roll) was by far the smallest. Until 1968 only 2 percent of all the air power used in Southeast Asia was devoted to operations there. The goals of both the North Vietnamese and the United States were the same for the area. Both sides realized that the fate of Laos was tied directly to the outcome of the battle in South Vietnam, and neither side aimed for complete victory in the tiny kingdom. The war followed a seasonal pattern. Each year between November and April, the dry season, the North Vietnamese and their Pathet Lao allies swept westward across the central Plain of Jars, stopping short of the capital. When the rains resumed in April and May, they were driven back by government forces and Meo tribesmen supported by American air power.

The United States supported these operations because they tied down large numbers of North Vietnamese, who would otherwise be freed to fight in South Vietnam, and because Americans gained access to territory from which they could both monitor the infiltration down the eastern trails and direct the bombing campaign over North Vietnam. Operations in Laos had little raison d'être of their own. Since northern Laos was a sideshow, living in the shadow of the greater effort to the east, the United States never developed as clear a policy for the war in that country as it did for the other wars. One of the ambassadors later told Congress that he could not recall having received more than half a dozen instructions from the State Department in over four years.[15] Into the

vacuum created by this absence of guidance flooded varied and at times competing programs, diluting what would appear on the surface to be the ambassador's total authority to control the war.

The United States Air Force flew two types of missions over northern Laos. On the one hand fighter-bombers from Thailand struck at the network of roads and trails over which equipment and men flowed from North Vietnam to the Pathet Lao. On the other, American planes led by forward air controllers covered Meo ground troops when they were engaged with the enemy.

Although the ambassador was responsible for American activities in Laos, the 1962 agreement relative to the kingdom prevented the United States from stationing planes in the country. The embassy had to borrow planes from the Seventh Air Force in Saigon. While Seventh Air Force had the planes, however, it had little say in how they would be used. Air Force aircraft for all four wars came from a common pool tended by the Seventh Air Force commander. First priority for using these planes went to the needs in South Vietnam, followed closely by the requirements for strikes against infiltrators in southern Laos. North Vietnam and northern Laos got what was left. In fact, the majority of missions were flown in northern Laos by airplanes diverted from North Vietnam or from southern Laos either because of poor weather or lack of immediate targets in those areas. The Seventh Air Force commander had to weigh each request that came to him from Vientiane against competing demands for aircraft elsewhere. Since he was responsible for not only the quantity but also the types of planes needed in four theaters, he tended to view the war in northern Laos differently than did the ambassador. Being closer to the ground action, the ambassador wanted planes to support Laotian ground forces in their battles with the enemy. The Air Force, taking a broader view, wanted to concentrate on interdicting the supplies coming in from North Vietnam and being stored behind the battle lines.

This underlying difference of viewpoint surfaced in various ways during the nine years of fighting in northern Laos. Several times the ambassador sought to have some of the planes set aside for his exclusive use. The Air Force resisted any attempt, whether on the part of the Marine Corps or the U.S. Army in South Vietnam or by the ambassador in Vientiane, to carve out separate globules of air power to be dedicated to only one type of mission. In its view, airplanes should be used to perform several different roles, and aircraft were most effective if they were controlled by the air commander in Saigon, who could move them about to satisfy different requirements. In short, the

One of Washington's principal concerns was to avoid involving Communist China and the Soviet Union in the war.

Air Force insisted on maintaining flexibility.

Thus disagreement erupted from time to time into controversy over which type of aircraft was best for the limited war in northern Laos: propeller-driven planes, which could get closer to the action but were vulnerable to ground fire, or jets, which flew faster and higher but were less prone to hits from below. The ambassador in Vientiane, wedded to close air support in this relatively relaxed war, pleaded for more propeller planes. The Air Force favored jets since they were better for interdiction and could also be used in the other wars. Since by early 1968 propeller planes had been virtually driven from the skies over North Vietnam and southern Laos by sophisticated enemy anti-

aircraft weapons, the only place they were still effective was in northern Laos. The Air Force viewed the ambassador's requests for these planes as attempts to create his own air force composed of planes that could not be used elsewhere. Although the controversy simmered on, the Joint Chiefs and the Secretary of Defense supported jets and, by inclusion, emphasis on interdiction rather than close air support. In order to get planes, the ambassador traded away some of his control over the military with which he was originally endowed. Even though the ambassador had authority to validate the targets that would be hit, the finite nature of Air Force resources and the Air Force's need to control their use resulted in substantial de facto military control of operations.

Whereas in North Vietnam it was the process of target selection that took the edge off civilian control, in northern Laos the absence of attack planes in the country had the same kind of effect but to an even larger degree.

Southern Laos

American air attacks against North Vietnamese infiltrators on the Ho Chi Minh Trail in southern Laos began in sporadic fashion early in 1965 as an adjunct to Rolling Thunder. Although the North Vietnamese had been using the network of roads and trails as a two-way street for years, intelligence reports noted a major increase of southbound traffic late in 1964 and into the early months of 1965. Planes from both South Vietnam and Thailand began striking trucks, truck parks, transshipment points, and enemy soldiers in April of 1965 in what soon became a regular series of interdiction campaigns.

Civilian control bowed to the reality of an overwhelming military presence.

As in northern Laos, weather determined the timing of the bombing programs. The North Vietnamese moved supplies and people during the dry season (November through April) and repaired and restocked supplies during the remainder of the year when the roads became muddy and impassable. American planes hit them during the dry periods and planned for the coming campaign when it rained.

At first these strikes, like those over North Vietnam, were limited by political factors. One of Washington's principal concerns was to avoid involving Communist China and the Soviet Union in the war. Also, since the planes were bombing in Laos from bases in South Vietnam and Thailand, the ambassadors in those three countries played an important political role in controlling the strikes. Of particular sensitivity was the position of the Laotian government. Technically the Laotians were neutral in the war between the Vietnams. The American ambassador in Vientiane strove to preserve this neutral stance and adopted the position that American military interests should not interfere with it. He was insistent that the United States could not carry out its interdiction program in southern Laos without the full cooperation of the Laotian Prime Minister, Souvanna Phouma, and that Souvanna's confidence could be gained only by being completely frank with him. This meant that the United States, if necessary, would have to pull its military punches on the trail if failure to do so would jeopardize the political situation. Air operations would have to be controlled very carefully. Pilots were ordered to abort missions, for example, rather than inflict damage on friendly villagers. The Air Force would have to forego the use of napalm

rather than risk the alienation of a friendly people and government. In short, the United States would have to bend over backward in executing its military mission in order to maintain the political foundation of its activities.[16]

But while neat in theory, this picture of civilian control was modified in practice by the "fog of war." In southern Laos, this fog consisted of bad weather and heavy jungle and mountainous terrain, similarity of targets, an elusive enemy, inadequate navigational aids to handle more than 5000 strike sorties a month, and a most complex set of bombing rules devised precisely to avoid political embarrassment. In one way these factors tended to increase civilian oversight of the bombing. Because of them there occurred from time to time accidental bombing of friendly troops, civilians, and villages. Each time such an incident took place the ambassador had to explain to the prime minister what went wrong. As a result, controls over the bombing became progressively stricter.

. . . greater restrictions on air power arose from within the military itself.

But in another, more subtle way the climate and terrain of southern Laos modified the ambassador's control. As in the northern part of the country, targets were at first nominated by the embassy staff to Seventh Air Force in Saigon. These targets were discovered by embassy-dispatched ground teams that roamed the countryside reporting by radio the location of supplies and soldiers that should be struck. The Seventh Air Force commander found this system of locating and reporting unsatisfactory. Due to atmospheric and climatic conditions, the reports were often so late that the enemy had gone by the time the planes arrived. In addition, the heavy jungle canopy made it difficult for pilots to find the targets that had been reported to them by someone else. The terrain and climate also made it next to impossible for planes to follow up their strikes with reconnaissance missions to assess the results of their bombing. As its navigational and reconnaissance equipment improved over the years, the Air Force found it much more effective to locate its own targets, and its success in hitting them and reporting the results improved greatly. The embassy's control of targets was weakened.

Another factor worked against the ambassador's tight control of targets on the trail—the use of B-52s in the interdiction campaign starting early in 1966. The question of who would control the big bombers was carried on in strictly military channels between the Strategic Air Command, the Military Assistance Command in Saigon, and Seventh Air Force. While delicate compromises were worked out to ensure that the huge planes would be able to perform their role in Southeast Asia without being diverted from their worldwide strategic alert mission, these decisions involved civilians in the theater only peripherally.

The momentous events of the first half of 1968—the Tet offensive in February, the announcement in March of the coming end of Rolling Thunder, and the American decision in the summer to begin deescalating in Vietnam—virtually ended the ambassador's control of air operations along the trail. When the bombing stopped over North Vietnam, it intensified in southern Laos. As a result, the portion of southern Laos that bordered on South Vietnam came to be treated as an extension of the battlefield in South Vietnam and came under the control of the military commander in Saigon. The Air Force had built a large infiltration monitoring center on

aircraft weapons, the only place they were still effective was in northern Laos. The Air Force viewed the ambassador's requests for these planes as attempts to create his own air force composed of planes that could not be used elsewhere. Although the controversy simmered on, the Joint Chiefs and the Secretary of Defense supported jets and, by inclusion, emphasis on interdiction rather than close air support. In order to get planes, the ambassador traded away some of his control over the military with which he was originally endowed. Even though the ambassador had authority to validate the targets that would be hit, the finite nature of Air Force resources and the Air Force's need to control their use resulted in substantial de facto military control of operations.

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At first these strikes, like those over North Vietnam, were limited by political factors. One of Washington's principal concerns was to avoid involving Communist China and the Soviet Union in the war. Also, since the planes were bombing in Laos from bases in South Vietnam and Thailand, the ambassadors in those three countries played an important political role in controlling the strikes. Of particular sensitivity was the position of the Laotian government. Technically the Laotians were neutral in the war between the Vietnams. The American ambassador in Vientiane strove to preserve this neutral stance and adopted the position that American military interests should not interfere with it. He was insistent that the United States could not carry out its interdiction program in southern Laos without the full cooperation of the Laotian Prime Minister, Souvanna Phouma, and that Souvanna's confidence could be gained only by being completely frank with him. This meant that the United States, if necessary, would have to pull its military punches on the trail if failure to do so would jeopardize the political situation. Air operations would have to be controlled very carefully. Pilots were ordered to abort missions, for example, rather than inflict damage on friendly villagers. The Air Force would have to forego the use of napalm

rather than risk the alienation of a friendly people and government. In short, the United States would have to bend over backward in executing its military mission in order to maintain the political foundation of its activities.[16]

But while neat in theory, this picture of civilian control was modified in practice by the "fog of war." In southern Laos, this fog consisted of bad weather and heavy jungle and mountainous terrain, similarity of targets, an elusive enemy, inadequate navigational aids to handle more than 5000 strike sorties a month, and a most complex set of bombing rules devised precisely to avoid political embarrassment. In one way these factors tended to increase civilian oversight of the bombing. Because of them there occurred from time to time accidental bombing of friendly troops, civilians, and villages. Each time such an incident took place the ambassador had to explain to the prime minister what went wrong. As a result, controls over the bombing became progressively stricter.

. . . greater restrictions on air power arose from within the military itself.

But in another, more subtle way the climate and terrain of southern Laos modified the ambassador's control. As in the northern part of the country, targets were at first nominated by the embassy staff to Seventh Air Force in Saigon. These targets were discovered by embassy-dispatched ground teams that roamed the countryside reporting by radio the location of supplies and soldiers that should be struck. The Seventh Air Force commander found this system of locating and reporting unsatisfactory. Due to atmospheric and climatic conditions, the reports were often so late that the enemy had gone by the time the planes arrived. In addition, the heavy jungle canopy made it difficult for pilots to find the targets that had been reported to them by someone else. The terrain and climate also made it next to impossible for planes to follow up their strikes with reconnaissance missions to assess the results of their bombing. As its navigational and reconnaissance equipment improved over the years, the Air Force found it much more effective to locate its own targets, and its success in hitting them and reporting the results improved greatly. The embassy's control of targets was weakened.

Another factor worked against the ambassador's tight control of targets on the trail—the use of B-52s in the interdiction campaign starting early in 1966. The question of who would control the big bombers was carried on in strictly military channels between the Strategic Air Command, the Military Assistance Command in Saigon, and Seventh Air Force. While delicate compromises were worked out to ensure that the huge planes would be able to perform their role in Southeast Asia without being diverted from their worldwide strategic alert mission, these decisions involved civilians in the theater only peripherally.

The momentous events of the first half of 1968—the Tet offensive in February, the announcement in March of the coming end of Rolling Thunder, and the American decision in the summer to begin deescalating in Vietnam—virtually ended the ambassador's control of air operations along the trail. When the bombing stopped over North Vietnam, it intensified in southern Laos. As a result, the portion of southern Laos that bordered on South Vietnam came to be treated as an extension of the battlefield in South Vietnam and came under the control of the military commander in Saigon. The Air Force had built a large infiltration monitoring center on

the Laotian-Thai border from which it used air-dropped sensors to keep track of movement on the trail. As more and more targets were developed from this center, the role of the ground teams, and with it more of the ambassador's control, waned. Both the ambassador and Souvanna were more interested in the war in the northern part of the country which posed a more direct threat to the government. Consequently, they were willing to trade off control of strikes on the trail for more aerial assistance in their fight against the Pathet Lao. The aerial interdiction campaigns against the trail between 1968 and 1971 (called Commando Hunt) were solely military in purpose and were controlled from Saigon with little interference from Vientiane.

The objective of the air attacks in both parts of Laos, north and south, was military: interdiction and close air support in the north, interdiction alone in the south. Although an eye was kept on the fragile status of the Laotian government, the air strikes were designed not for political persuasion but for stopping or slowing down the enemy. From this aspect, it is of secondary importance whether control was exercised by civilian-clad members of the embassy in Vientiane or uniformed airmen in Saigon. The purpose was military and, therefore, so became the control.

South Vietnam

Before the United States decided in 1965 to send ground forces to South Vietnam, the American air effort consisted of training and advising the Vietnamese Air Force (VNAF). Air operations were strongly flavored by both the political relations between the north and the south and by the internal politics of South Vietnam. American Air Force advisers were prohibited from flying combat missions, although it proved impossible to train the Vietnamese without doing so at times.[17] Aircraft bore Vietnamese insignia, and no jets were thrown into combat. The voice of the American ambassador in Saigon was heard throughout the councils, which determined the nature and extent of American participation.

South Vietnam still exhibited many of the characteristics of a feudal society. It was still largely decentralized with a weak degree of sovereignty emanating from Saigon. The people of the country lacked a tradition of looking to the government for strong central direction. Military, as well as economic, social, and political, affairs tended to break down into parochial groups and be colored more by local conditions than by a sense of nationalism. The VNAF was a poor country

Many uniformed people will continue to bemoan the restrictions and controls that prevented them from doing their best.

cousin of the Vietnamese army which controlled it and which itself had strong political overtones. The VNAF was politicized not only in the sense of organizational control but also in its mission and its modus operandi. It was split into four parts, each assigned to one of the army corps. Even though the Americans had introduced the idea of centralized control and worked to strengthen VNAF headquarters, the force still operated largely on the local level. For example, targets were chosen and approved by the local civilian chief of the province in which the fighting was taking place. It was not unheard of for a province chief to call in air strikes on his personal political enemies who were not

Vietcong at all. Even at the "national" level the air force figured prominently in political shakeups. A substantial part of the force was always kept on "coup alert," ready for action if the political opponents of the incumbent head of state threatened to oust him. In September 1964, for example, Prime Minister Nguyen Khanh remained in power in the face of an attempted coup solely because the chief of the air force refused to contribute his planes to the revolt.

The large infusion of American ground and air forces starting in mid-1965 changed this. The American decision to intervene militarily was an admission that earlier attempts to defeat the Vietcong by economic and political means were not working. The principal focus now became military, and the commander of the Military Assistance Command for Vietnam (MACV) was given wide-ranging control of the war. There remained, of course, organizational guidance from Washington. Military plans and requests for forces and materiel were approved there. The objectives of the war were also determined there. Military operations were harnessed to the national goal of, at first, defending the South Vietnamese from the insurgents and, after 1968, of preparing them to defend themselves.

The United States government placed a remarkable amount of trust in the judgment of the MACV commander and denied him little that he requested. In 1965 the Secretary of Defense assured the military that it would be given whatever was needed to turn the tide.

Partially to avoid the Vietnamese political limitations, which had plagued the earlier advisory effort, and partly to defuse a possible Communist charge of colonialism, the MACV commander, General Westmoreland, kept the American military command separate from that of the Vietnamese, thereby allowing him to pursue American solutions to his military problems. In theory, Westmoreland was a member of the "country team," that is, a member of the ambassador's staff and subject to his overall authority. But the preponderance of military force in the country rendered such authority largely fictional. A good illustration of this is the pacification program, which attempted to keep the loyalty of the rural population by protecting them against the Vietcong and improving their living conditions. This was essentially a civilian idea pursued by the Saigon government for years with little success. It did not stop when the Americans arrived in force. In 1966 American support for pacification was increased and reorganized and put on a more formal footing. Since it began at the local district and provincial levels, and American military advisers were already predominant at those levels, the entire program was placed under the control of General Westmoreland. The President appointed a special representative with the rank of ambassador to oversee the program, but he was placed on the staff of the MACV commander.[18] Civilian control bowed to the reality of an overwhelming military presence. Yet the controlling idea was civilian, even though responsibility for its success resided in a uniformed general.

The position of the Air Force in this command structure was an intricate one, complicated little by civilian control but seriously by the military command and control arrangements that had evolved over time.

Restrictions imposed on air power in South Vietnam itself by "civilian control" were of two types, neither totally civilian nor particularly stultifying. The most general inhibition was a strategic one, the early decision to emphasize the ground war in the south rather than bombing the north. This decision was an amalgam of civilian and military thinking. It satisfied the civilian desire to be able to picture the war to the enemy and to the world as a defensive one and avoid making it appear like an attempt to

subdue and conquer the north. But it was also the strategy favored by the American ground forces, which saw it as the only immediate solution to the imminent collapse of South Vietnam in the summer of 1965. Many in the Air Force continued to believe this was the wrong way to go and felt that air power was not being used to its best advantage when it was employed as a backup to ground fighting.

The second type of "civilian" restriction was embodied in the rules of engagement that prohibited aircraft from operating in certain specified politically sensitive areas, such as near or across neighboring borders or around populated regions where mistakes could prove to be especially embarrassing politically.

But greater restrictions on air power arose from within the military itself. The Air Force had much wider responsibilities than did the other services and consequently a much more complicated system of controls. For the bombing campaigns against the north, the Seventh Air Force commander in Saigon worked for the Joint Chiefs, who acted through a military command in Hawaii. For air operations in northern Laos, he coordinated with the ambassador in Vientiane. For the war in South Vietnam, which later came to include the extended battlefield in southern Laos, a small southern section of North Vietnam, and Cambodia (now Kampuchea), he was the MACV commander's deputy for air operations. At the same time, he came under the cognizance of the Chief of Staff of the Air Force in Washington. Serving so many masters led inevitably to doctrinal differences and, at times, seemingly irreconcilable pressures on the Seventh Air Force commander. Convinced of the correctness of Air Force doctrine on the indivisibility of air power, for instance, the air commander in Saigon, while on paper responsible for all air power in South Vietnam, found himself pressured to split his assets into four almost separate air forces—the United States Army, Marine Corps, and Navy and the Vietnamese Air Force—each striving to do its own thing. The constant centrifugal pull of these forces represented a major limitation to his ability to maintain the flexibility of air power he needed.

In sum, greater control was exercised on air power within South Vietnam by the military, whether that word be defined as uniformed people or military ideas, than by civilians and civilian concepts.

ANALYSIS of civilian control of the military at the Washington decision-making level is useful during peacetime, when carefully negotiated separation of powers does not have to be tried in the crucible of combat. (Even on this level, however, the traditional definitions of "civilian" and "military" should be altered to include ideas as well as people.) But the best laid plans of control are inevitably confounded in wartime when they become subjected to personal, doctrinal, political, economic, and psychological pressures, few of which can be fully foreseen or planned for. The "fog of war" still remains beyond the grasp of the computer.

In a war such as that which was fought in Southeast Asia, the lines between civilian and military are blurred even more than in a more conventional conflict. This makes it even more important to rely on ideas as well as the people who create them. No clear-cut conclusion on the lines in the Southeast Asia conflict is possible. Many uniformed people will continue to bemoan the restrictions and controls that prevented them from doing their best. From their point of view they are justified, even though controls appeared to have come as frequently from within the military as from without. Some civilian-suited individuals, on the other hand, still look back on the conflict as one in which military power was properly tailored to fit the

body of national objectives. And from their perspective, they, too, are right. In the face of these divergent viewpoints, about all that can be concluded from the experience is that civilian ideas were as often expressed and acted on by the military as were military ideas by civilians and that the most fruitful locus of investigation into civilian control of the military during wartime lies not as much on the planning level as on the field of battle.

Washington, D.C.

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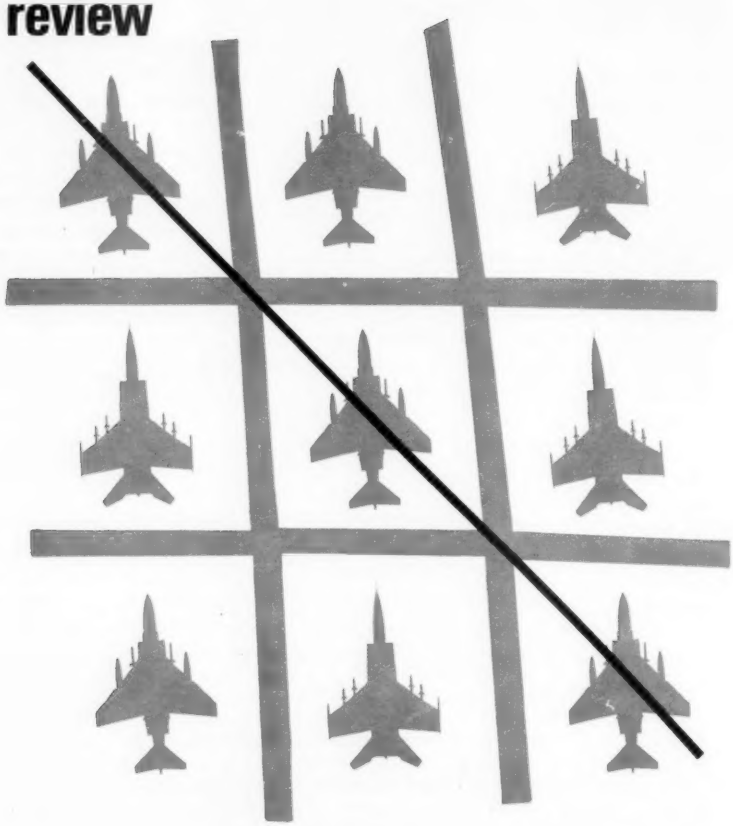
The Southeast Asia experience was marked by great frustration—frustration flowing from the lack of a clear, definable, attainable objective and means for measuring success in achieving that objective—frustration arising from constraints that could only appear unreasonable to airmen—frustration from stringent rules of engagement which tended to offset advantages in skill and technology. This, however, should not be permitted to obscure the great dedication and zeal with which the men and women of the Air Force invariably carried out the job given them in Southeast Asia—despite the fact that missions, tactics, and targets frequently seemed inconsistent with their experience, training, and doctrine. The entire episode provides eloquent testimony to the disciplined professionalism of Air Force people.

DAVID C. JONES, GENERAL, USAF, Chief of Staff, taken from the Foreword of *The United States Air Force in Southeast Asia* (Washington: Government Printing Office, 1977).

air force review



TECHNOLOGICAL COMPETENCE AND THE MILITARY COMMANDER

DR. J. S. PRZEMIENIECKI

OF THE more important attributes of a senior Air Force officer are those that enable him to conduct successful military operations. These attributes were once equated to the military qualities of a warrior—his operational prowess, wisdom, dedication, and courage; but in today's technologically intensive Air Force, another important dimension must be included among those necessary qualities of the military leader. This dimension is technological competence. It enables an officer to make decisions based not only on experience and judgment but also on scientific methods of analysis and information processing for the planning and execution of military operations.

Technological competence will become increasingly essential during the 1980s, when many of the underlying concepts of strategy and tactics will undergo significant evolutionary changes as a result of the introduction of new weapon systems. Sophisticated weapons with automatic capabilities, such as precision-guided munitions and advanced command, control, and communication systems, will require a new generation of Air Force officers capable of using the full potential of the emerging computerized force structure. Also, with austere defense budgets, not only must the systems themselves be cost-effective over the total life cycle but also their performance in the operational environment must be optimal.

The requirement to maintain and operate technologically complex weapon systems implies the need for people with superior technical capabilities to develop, acquire, and operate them also. Consequently, the operation of appropriate education and training programs for the Air Force, incorporating the latest scientific methods and techniques in military operations, is tantamount to maintaining effective military forces.

Historical Perspectives

The use of scientific methods to enhance the effectiveness and success of military operations is not new. About 214 B.C. Archimedes helped break the Roman naval siege of Syracuse by designing machines of war, including catapults and missile throwers that terrified the Romans. One legend is that Archimedes constructed concave mirrors that burned the ships of Roman general Marcus Claudius Marcellus by concentrating the sun's rays on them.[1] This unusual defensive measure could perhaps be described as the first application of a directed energy weapon. In more recent times Napoleon, during his Egyptian expedition of 1798, enlisted the services of the famous French mathematician Jean Baptiste Joseph Fourier.[2] World War I witnessed the first serious attempts to apply established scientific methods to the solution of military operational problems. In 1916 Frederick Lanchester developed a mathematical analysis of air combat,[3] which later served as a fundamental model in developing theories of combat and calculating attrition rates in military operations. Also during World War I, Thomas Edison conducted investigations into submarine warfare for the United States Navy.[4] World War II provided still further impetus to such applications; and the discipline of operations research, in which scientific methods were applied to improve military operations, was born.[5]

This new discipline originated in the United Kingdom, where it was called operational research. It resulted from the initiative of A. P. Rowe, Superintendent of the Bawdsey Research Station, who organized research teams to develop effective techniques for using the then newly developed radar to locate enemy aircraft. At the outbreak of war on 1 September 1939, Rowe

sent a small group of scientists from Bawdsey to the Royal Air Force fighter command headquarters at Stanmore.[6] This group played a very important role in developing interception tactics for British fighter aircraft, tactics that played a decisive role in the Battle of Britain. By 1941 formal operational research groups had been established in all three of Britain's military services.

As in Britain, the introduction of radar was responsible for stimulating scientific development in the U.S. Army Air Forces. In October 1942, General Henry "Hap" Arnold urged all commands to establish operations research groups, and, by the end of the war, 26 such groups were in existence.[7]

After World War II, operations research in both military and industrial applications began rapid growth. In the United States the Operations Research Society of America was formed in 1952, followed by the Military Operations Research Society in 1966. Also a number of private and governmental organizations in operations research were established, such as the Institute of Defense Analyses in Washington, and the Studies Analysis and Gaming Agency within the Department of Defense. In Germany Industrieanlagen-Betriebsgesellschaft was established as the principal institution in defense research for the German armed forces. In the United Kingdom the Defense Operational Analysis Establishment was created to assist the British Ministry of Defense. Some of the other prominent centers of military operations research in Europe are the SHAPE (Supreme Headquarters Allied Powers, Europe) Technical Center in The Hague, the Norwegian Defense Research Establishment, and the Centre Interarmées de Recherche Opérationnelle in France.

The importance of operations research is emphasized at the highest echelons of the United States Army, Navy, and Air Force. The Army has an office of the Deputy Undersecretary (Operations Research); the Navy operates the Center for Naval Analyses; and the Air Force has its Studies and Analysis Office on the Air Staff.

There are indications in the Soviet Union that applications of scientific method to military operations also receive much attention. Having achieved a substantial numerical superiority in weaponry, the Soviets are now placing greater emphasis on combat readiness of their armed forces. Their force mobility, striking force, and firepower have increased in recent years, and the forces are showing greater concern for qualitative development.[8] In pursuing this goal the Soviets are striving for continuing introduction of the achievements of science and technology into military practice.[9] Modern mathematical techniques are being applied to determine the optimum use of weapon systems, to achieve a better theoretical understanding of the conduct of large military operations, and to analyze the effectiveness of weapon systems.[10]

The importance of science and technology in Soviet military practice was underscored by the late Soviet Minister of Defense and Marshal of the Soviet Union A. A. Grechko when he wrote:

> In this regard, the interests of reliable defense of the Soviet Motherland demand that we do not let up on the scientific exploration front, that we continue scientific research and experimental design work, that we make use of the results of scientific and technical progress for creation of planning models of weapons and combat equipment, and that we reduce the time for the introduction of the results of scientific research into production.[11]

The Scientific Method in Military Operations

To illustrate the scope of scientific methods and techniques in military operations, this section provides a cursory summary of the more important categories. However, the list is by no means complete.

theory of combat

As previously mentioned, in 1916 Lanchester developed basic concepts for a theory of combat. He stated that if the number of blue combatants (or weapons) is denoted by X_B then the attrition rate of the blue force dX_B/dt is equal to the product of the effective firing rate of the red force α_R and the number of the red combatants (or weapons) X_R. Mathematically, this is expressed as

$$\frac{dX_B}{dt} = -\alpha_R X_R$$

where t denotes time and the negative sign signifies attrition, i.e., force reduction in combat. Similarly, for the red combatants (or weapons)

$$\frac{dX_R}{dt} = -\alpha_B X_B$$

These equations, or their modified forms in which α_B and α_R are not constant but vary with time and depend on the size of forces involved, are still used today in various analytical studies to express attrition rates in combat. Exact solutions of these equations are obtained in terms of hyperbolic functions (cosh and sinh) as shown:

$$X_B/N_B = \cosh(\sqrt{\alpha_B \alpha_R}\, t) - S^{-1} \sinh(\sqrt{\alpha_B \alpha_R}\, t)$$

and $$X_R/N_R = \cosh(\sqrt{\alpha_B \alpha_R}\, t) - S \sinh(\sqrt{\alpha_B \alpha_R}\, t)$$

where $S = (N_B/N_R)\sqrt{\alpha_B/\alpha_R}$ = force superiority parameter

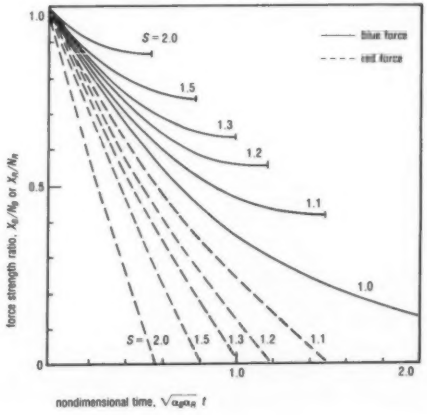
and $\sqrt{\alpha_B \alpha_R}\, t$ = nondimensional time

N_B represents the number of blue combatants (or weapons) at the beginning of combat engagement (i.e., $t = 0$), and N_R is the corresponding number of the red forces.

The parameter S can be used to measure the force superiority of either blue or red forces. If S is greater than one, the blues are stronger than the reds, and the combat engagement will end in victory for the blues when the red force strength is reduced to zero, as shown in Figure 1; if S is less than one, the opposite is true; and if S is equal to one, neither side has an advantage. The parameter S can also be used to gain some insight into a perennial argument for quantitative versus qualitative superiority. Noting that neither side has an advantage when S is equal to one, we can then relate the quantitative superiority N_B/N_R to the qualitative superiority α_B/α_R, as shown in Figure 2. Thus if the reds outnumber the blues numerically by two to one (i.e., $N_B/N_R = 0.5$), the blues will need a four-to-one qualitative advantage to achieve parity (i.e., $\alpha_B/\alpha_R = 4$).

These simple results can only be regarded as a gross approximation to the real situation.

Figure 1. Variation of force strength ratio with time. The abscissa represents the ratio of surviving forces in terms of their original strengths. The higher the value of S *the shorter the time to annihilate the red force.*



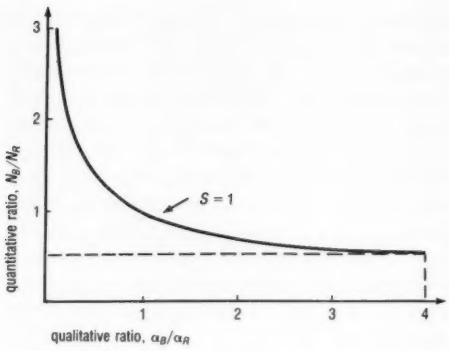


Figure 2. Variation of the quantitative strength ratio N_B/N_R with the qualitative strength ratio α_B/α_R to achieve force parity in a combat engagement

Nevertheless, they allow us to obtain useful insights into the dynamics of combat and identify the critical parameters affecting the attrition rates. Other applications of scientific methods to military problems are discussed here in considerably less detail.

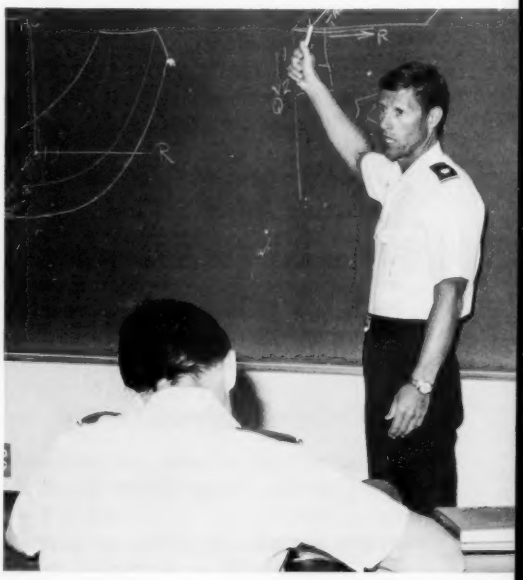
probability theory and statistics

The theory of probability is a branch of analysis in which a function called the probability expresses the likelihood of an event to occur. The value of the probability function varies between 0 and 1. In some situations this function can be estimated through a numerical data gathering. The process of analyzing and making inferences from the data is encompassed in statistics theory. For example, gun or missile dispersion data can be used to determine the circular error probable. Probability theory can be used to determine the probability of kill (PK), to obtain mathematical models of target coverage, and to design test procedures through which systems or equipment reliability can be established with a specified degree of confidence. One of the most useful theorems in probability theory is the conditional probability theorem (Bayes' theorem), which is used to determine probabilities of hit for multiple shots or for salvos.

decision theory

Recently, the methods of statistical inference have been modified under the general description of decision theory to analyze decision-making in the face of uncertainty—a common situation in military operations. Decision theory deals with a set of possible states that can be modified by the acts of the decision-maker. If all possible consequences of the acts are known and can be assigned utility factors, then an optimal choice of acts

Students enrolled in AFIT's Strategic and Tactical Sciences (S&TS) studies, an 18-month graduate program, acquire analytical techniques for investigating weapon system applications in the operational environment.



can be determined that maximizes the utility of all consequences incurred. The available choices are best illustrated by drawing a decision tree, on which all possible decision paths are shown. If several consecutive decisions are needed, the selection process may call for the use of computers to find the optimum path.

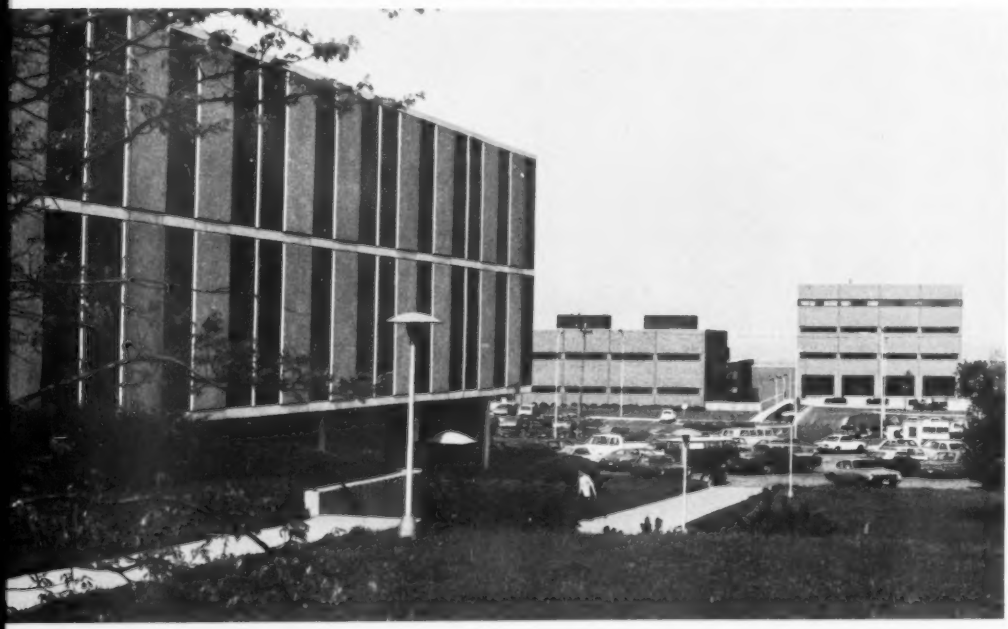
linear programming

The analysis techniques known as linear programming have been developed to solve problems of allocation of resources subject to various constraining conditions. Such problems arise whenever a number of activities must be performed but limitations on either the amount of resources available or the manner in which these resources can be allocated prevent accomplishing each separate activity in the most effective way. The linear programming technique determines how these resources should be allocated in order to optimize the total effectiveness of the system. Problems that can be solved using this technique include the allocation of cargo among different types of aircraft for air logistics support, allocation of sorties to a target, allocation of bombs to a target system, and munitions storage.

queueing theory

Queueing theory deals with people or items in sequence and is used to minimize the cost of providing service or the waiting time of

The Air Force Institute of Technology (AFIT) at Wright-Patterson AFB, Ohio, is the Air Force's principal agency for specialized professional and technological education. The Engineering Building is one of AFIT's newer facilities.



users. Many maintenance problems in the Air Force can be treated as queueing problems, since items requiring service are like users of service. Moreover, inventory problems and sortie generation can be treated as queueing problems. Some military operations consist of a network of tasks to be carried out only once, some simultaneously, and some in sequence. In such processes coordination of starting times is necessary to optimize the final outcome. Queueing theory is useful here in determining optimal schedules.

network analysis

Network theory can be applied to the network routing problems that commonly arise in communication and airlift support. A typical problem is finding an optimum route (fastest, least costly, shortest, or most survivable) between two or more locations in relation to the total time, cost, distance, or survivability. Air Force applications of network theory are important in flight scheduling, logistics support, and determining the survivability of communication networks or strategic bombers.

game theory

Game theory is used to study conflict situations involving more than one decision-maker. Its mathematical form is in many respects similar to situations represented by common games of strategy, such as poker, tic-tac-toe, checkers, bridge, and chess. Conflict situations arise if the interests of two or more sides pursuing different goals clash. Without doubt, any situation in combat actions can be classified as a conflict situation. The main purpose of using game theory is to draw up plans of action for the rational behavior of the players involved. The plans represent optimal strategies for each player. Game theory provides a number of theorems applicable to studies of choices of different military strategies.

differential games

Differential games are used to study conflict situations in which the players may vary their strategies with time. Only a very limited number of problems can be solved. The most important class for which solutions are available is that of pursuit games in which two persons are involved, the pursuer and the evader. This class of problems has practical applications in the study of pursuit and evasion in air battles or the pursuit of a missile by an antimissile.

war-gaming and simulation

Through the process of modeling the real environment, military operations can be simulated by means of war-gaming or computer simulations. In war-gaming, which may involve map maneuvers, sand tables, or computer interactive games, people play roles to simulate the decision process, while simulations use computer algorithms to represent the decision-making process. Computer simulations usually employ random numbers to determine the outcome of random events and in such cases, because of the probabilistic nature of the outcome, are called Monte Carlo simulations.

Simulated warfare provides a means of gaining experience, exploring the consequences of alternative strategies and tactics, identifying weaknesses, and improving skills without the necessity of "acting out" the situation in the real world. War-gaming techniques have been used extensively to train officers in military forces throughout the world. Gaming exercises simulate the search for novel and more effective strategies and tactics and encourage innovation. But, more important, motivations aroused in war-gaming in peacetime may have carry-over values

that will pay off handsomely in the ultimate test of actual war.

New Program at AFIT

Recognizing that improvements in the management of operational planning of Air Force systems could be made through specialized graduate education, the Air Force Institute of Technology (AFIT) developed an 18-month graduate program in Strategic and Tactical Sciences (S&TS) leading to a Master of Science degree.[12] During the summer of 1976 the original concept was presented to the major operating commands and the Air Staff. Although the program grew out of an AFIT initiative, it was structured in response to potential user needs. The first class of students entered the AFIT program in August 1977 and graduated in March 1979.

The S&TS curriculum has been designed in response to the growing need for quantitative and analytical techniques in operational planning and execution. This new curriculum can be construed as a merger of three academic areas: military operations, quantitative sciences, and weapons engineering. In effect the curriculum creates a new operation-oriented scientific discipline unique in its conceptual philosophy and intended applications. The curriculum presents an interdisciplinary program educating generalists in skills spanning the range of modern military engineering.

Although the S&TS program includes the essential analytical techniques in conventional operations research degree programs, it differs from them in two important respects: First, all practical applications of analytical techniques discussed in the classroom pertain to military operations; and, second, students acquire considerable background knowledge of operations and the engineering of weapon systems. Consequently, graduates from the program have a good knowledge of the potentials and limitations of military systems. This knowledge combined with analytical skills prepares them to perform meaningful analysis for weapons planning, employment, targeting, threat assessment, and performance optimization in a given strategic or tactical scenario.

To emphasize the value of this program to the Air Force, perhaps it is sufficient only to mention the types of problems studied in the Effectiveness/Trade-off Studies course included in the program. Among the problems are the following:

- The definition of measures of weapon systems effectiveness and the combination of these measures into objective functions
- The specification of alternative means of employing weapons and supporting resources and the construction of new alternatives
- The description of weapons and resources available for use and the nature of constraints on their use
- The process of determining appropriate criteria for choosing preferred alternative means of weapon employment.

Students in the program are required to complete an independent thesis research project on a topic selected from strategic and tactical problems provided by the Air Force. The first class dealt with such typical topics as these:

- Comparison of the tactical air-to-ground systems effectiveness model and Red Flag operational training exercises
- Simulation model of attack helicopter survivability in a hostile artillery environment
- Inference of probability of kill of air-to-ground missiles in various attack modes
- Sensitivity of aircraft attrition estimates to aiming distribution parameters of anti-aircraft artillery.

THE military planner or decision-maker needs to know analytical tools and how and when to use them. The fast-growing requirement for technical managers of complex military operations has generated the need for operational commanders who possess quantitative skills at almost the same level as the engineer or professional analyst. The art of military operations has now been transformed into an "art-science" specialty, which evolves around modern weapon technologies and scientific methods of analysis. Simply knowing the technology of weapon systems is not enough; operational commanders must recognize strategic and tactical implications of the technologies involved and the available means of exploitation of these technologies in a possible military conflict.

Another important area to be emphasized by operational commanders and planners is the interaction between weapon systems development on the one hand and strategy and tactics development on the other. All too frequently new systems have been designed without a proper understanding of their expanded capabilities, which invariably require new tactics and deployment concepts. Concern has also been expressed that the elapsed time spent between the system design formulation and the development of tactics and doctrine is entirely too long.

Technological advances in weapon system design must be accompanied from their inception by studies of strategic and tactical innovations to take full advantage of the projected system capabilities. Accomplishing this requires the cooperation of operational officers, systems technologists, and systems designers. But most important, we need to educate a new breed of military experts who understand military operations and weapon systems engineering and technology and who, at the same time, can employ modern analytical tools from the quantitative sciences to enhance the efficacy of current and projected Air Force systems. In response to this need, the present graduate program in Strategic and Tactical Sciences at AFIT contributes significantly to the development of these new skills for the Air Force.

Air Force Institute of Technology
Wright-Patterson AFB, Ohio

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fire counter fire

A NEW MODEL FOR LAND WARFARE

the firepower dominance concept

LIEUTENANT COLONEL
ROBERT S. FAIRWEATHER, JR., USA

. . . direct annihilation of the enemy's forces must always be the dominant consideration.[1]

Clausewitz

THE modern battlefield promises levels of intensity and destruction never before approached by man. Technology has provided the warrior with sophisticated weaponry that far outstrips anything known in World War II. Weapons capabilities have advanced so fast, in fact, that armies have had great difficulties in updating tactical doctrine at the same pace, and the military man finds himself driven by technology rather than making technology the useful servant of doctrine. In order to regain our mastery over technology, I posit the thesis that firepower should be the dominant variable in the firepower-maneuver equation.

Though my views seem heretical in light of current doctrine, they are presented in all seriousness and do not depart significantly from a body of thought that reaches far back into history. For the most part, these views are derived from a careful study of guerrilla warfare, blitzkrieg tactics, air power doctrine, and concepts for mobile warfare in a fluid environment. The essence of the views is a vivid image of firepower-intensive engagements on a four-dimensional battlefield, where time is the fourth dimension and success depends on the destruction of mass with precisely timed pulses of violence.

The Traditional Firepower/Maneuver Model

All great armies of the world rest their land combat power on the tank. . . .tank strength is the foundation of NATO defense.[2]

Napoleon's military success, according to many historians, was due to his brilliant management of firepower and maneuver. Through the works of Jomini, Clausewitz, and a succession of military thinkers, Napoleon's basic model for land warfare has survived and, in a refined form, provides the basis for U.S. Army doctrine today.

This traditional model, while emphasizing the integration of maneuver and firepower, places maneuver forces in the dominant role and supporting firepower in a subordinate role. It rests on the principle that one must physically seize or hold terrain-oriented objectives by concentrating superior maneuver forces at points of decision in order to destroy the enemy. As a corollary to the principle, supporting firepower augments the combat power of maneuver forces and, in concert with the plan of maneuver, supports the attainment of maneuver force objectives.[3]

The advent of tactical air power changed this traditional land warfare model very little because aerial weapon systems were viewed by U.S. Army doctrine writers as just another form of flexible firepower with which to support ground forces. Although current doctrine now refers to land warfare as the "joint air-land battle," and combat power is considered to be an amalgam of firepower and maneuver, the dominant-subordinate relationship between maneuver forces and supporting firepower remains essentially the same. Changes to doctrine have centered mostly on procedures and methods for managing fire support, accomplishing joint interfaces, and applying new technology.[4] For some, these changes suffice, but there are at least a few military thinkers who believe that more than superficial changes are needed.

The Need for New Doctrine

> The greater amounts and types of firepower available on the battlefield have created extraordinary problems of fire support coordination. They have also brought into question the entire relationship between firepower and maneuver.[5]

There is a growing awareness that traditional doctrine may no longer meet the demands of warfare. Further evidence comes in the form of new trends and developments.

- First, technology has led to conventional weapons that can be fired at standoff ranges and do so with greatly enhanced accuracy and lethality. These weapons threaten to make even the mainstay of battle, the tank, obsolete.
- Second, technology has provided sophisticated means for penetrative and standoff reconnaissance, intelligence gathering, surveillance, and target acquisition (RISTA). These RISTA means can potentially eliminate many of the "mysteries" of war, especially the ones relating to enemy dispositions and intentions, and can provide real-time target data.
- Third, command, control, and communications (C^3) systems utilizing electronic and computer technology provide vastly improved capabilities for battlefield management. While allowing a high degree of efficiency through centralization, these C^3 systems do incur the drawback of themselves becoming primary targets.
- This leads to the fourth trend, the creation of a whole new field of military endeavor, electronic warfare. The objective of electronic warfare, stated succinctly, is to deny the enemy the use of his C^3, RISTA, and fire control means while protecting one's own means. Presumably, the electronic warfare advantage falls to the side able to field technologically superior equipment.
- Fifth, technology has also resulted in some other effects on warfare. For example, in opposition to the general rule that battles with movement (Waterloo) are decisive and battles without movement (World War I trench warfare) are indecisive, technology promotes a desire to stabilize the battlefield. The air defense umbrellas and antitank shields of today are most effective when left in place, and armies are reluctant to move away from them. Further, as demonstrated in the 1973 Yom Kippur War, technology is increasing the intensity, tempo, and attrition of war. Fast-paced, violent firepower duels promise to exhaust the opponents and

deplete their resources within a few days, making victory hang on the ability to reconstitute.[6]

- Sixth, there is no guarantee that land warfare will remain conventional. In all probability, tactical (and perhaps strategic) nuclear weapons will be used at some stage. If that happens, then the act of concentrating forces to achieve favorable combat power ratios may incur the penalty of presenting suitable nuclear targets to the enemy. A force that is unprepared to shift immediately from conventional to nuclear battle will be at a severe disadvantage. The necessary preparations go beyond just equipment and training and must include the development of a flexible doctrine.[7]
- Finally, Western nations are finding it increasingly more difficult to receive public support for maintaining large standing military forces. The monetary cost of providing the required equipment and its support is high, but even more at issue are the costs and other impacts of sustaining high levels of military manpower. As a result, Western military forces have been unable to keep pace with the quantitative and qualitative military improvements that continue to be made by the Warsaw Pact. The outgrowth of this has been the adoption of a "fighting outnumbered, while winning" concept,[8] which has little chance for success. Logic dictates that when you pit a small capable force against a large capable one and both follow the same basic doctrinal game rules, the smaller force is unlikely to win.

These trends and developments point to the need for new land warfare doctrine. Whatever form it takes, it must maximize the advantages of new technology while minimizing the disadvantages. It must be affordable and supportable by Western nations. Further, it must result in a credible deterrent while also providing the capability to defeat the Warsaw Pact or other enemies in the event of aggression. Ideally, it would make the Warsaw Pact's land warfare doctrine inoperative, thus placing the economic stress of massive military reinvestment on the Warsaw Pact nations. Finally, it must be a flexible doctrine that incorporates the tenets of both conventional and nuclear warfare.

The Second Echelon Interdiction Concept

To say that no one is working the doctrine problem would be highly inaccurate. The truth is that a large-scale joint second echelon interdiction study is in progress under the direction of TAC/TRADOC's Air Land Force Application Agency. The purpose of the study is to determine how best to integrate and apply both USAF and Army firepower means against the follow-on echelons of the Warsaw Pact ground forces. Conceptually, while NATO ground maneuver forces are defending against the attacking first echelon, joint supporting firepower means would be directed at the second echelon to attrit and delay it. The objectives to be achieved against the second echelon are straightforward. First, the second echelon would be delayed so that it would not arrive to reinforce until after the defending forces had defeated the first echelon. Second, since the defending forces would suffer attrition while fighting the first echelon, the second echelon would have to be attrited to the point where the defenders would retain an adequate defending combat power ratio. Also, it would be desirable to channel second echelon elements by firepower so that they would arrive in the close combat zone at places other than those of their choosing.[9]

To meet these objectives, NATO ground and air firepower means would be targeted in depth against the second echelon. One concept envisions early location of second echelon forces through deep reconnais-

sance.[10] Subsequently, a program of firepower attacks would be executed to strip away supporting elements, to impede and channel movement, and to cause cumulative attrition of overall combat capabilities. This same concept also visualizes large-scale firepower attacks to degrade the enemy's artillery and rocket forces located 5 to 20 kilometers behind the line of contact. These fire assets not only support the first echelon; they must also provide fire support for the second echelon when it reinforces, thus making them high-return targets.

Critical to the success of the foregoing concept is the flawless integration of joint ground and air firepower operations against the second echelon and in support of the overall air and land battles. Such integration will call for the establishment of a highly sophisticated C^3 system that can operate under all conditions of combat. This aspect is the principal area of concern in the ongoing study efforts.[11]

Significantly, the second echelon interdiction concept reflects a shift in military thinking. No longer must firepower be a total slave to the maneuver force battle at the line of contact. It is an important step leading toward the concept I propose and has had more than a passing influence on my own thoughts.

A New Air-Land Battle Model

> We'll need five days and five nights of real violence. . . .Our firepower will have a tremendous impact on their ground troops, breaking their will to fight in addition to killing them. After that, we'll need four more days to tidy up the battlefield.[12]
>
> Lieutenant General
> James F. Hollingsworth

If the second echelon can be made ineffective by the application of massed firepower, can the entire air-land battle be fought in the same manner? After extensive research and much reflection, I have become convinced that the answer is yes, if one is willing to accept new doctrinal approaches to warfare. One of these approaches is a conceptual air-land battle model, which I have named the firepower dominance (FIDO) concept. It is really only the bare framework of a model at this point, but it will serve as a means for me to convey my ideas.

The FIDO concept places firepower (that firepower which is not integral to ground maneuver forces) in the position of dominance on the battlefield. It does this in accordance with the following principles.

Firepower dominance. Firepower dominates over maneuver as the primary consideration for battle planning and execution. The firepower objective is to destroy and defeat enemy land and air forces. Maneuver forces are subordinate to firepower forces and will be utilized as a form of augmentation. Specifically, maneuver forces will cause the enemy to deploy, help channel the enemy into killing zones, destroy isolated enemy elements that escape firepower destruction, provide rear area security, secure assigned terrain, and be prepared to exploit the results of firepower.

Dispersal. Firepower and maneuver assets will be dispersed on the battlefield to avoid mass destruction by the enemy. This dispersal will be both in depth and width and accomplished at every level practical. The purpose of dispersal is to attain survival through the dilution of mass.

Concentration and deconcentration. Firepower will be systematically and rapidly concentrated on the enemy to destroy, delay, and disrupt his forces. From dispersed locations, firepower assets will place coordinated, integrated, and massed fires against enemy targets. These targets will be attacked in priority order, based on the tactical situation. Normally, first priority targets will include those enemy offensive firepower and maneuver forces that pose the greatest immediate threat. Friendly maneuver forces will con-

centrate only to execute assigned missions and then will deconcentrate.

RISTA saturation. Reconnaissance, intelligence gathering, surveillance, and target acquisition means will saturate the battlefield in depth and width to provide for accurate, timely, and continuous targeting and damage assessment. This is vital to ensure effective firepower management. RISTA means will be fully applied (within political constraints) on a continuous basis during peacetime to provide accurate targeting at the outbreak of hostilities. The purpose of this prehostility effort is to ensure that the first echelon be targeted and destroyed by firepower before it can penetrate in depth.

Centralized command and control. Command and control of the air-land battle will be highly centralized and will flow through a joint command and control structure that will reach to the lowest levels practical. This structure will also be responsible for the integration of all forms of firepower and for the integration of maneuver force operations into the plan of firepower. A joint centralized command, control, and communications (C^3) system will provide the means for command, control, and integration.

Flexible weapons employment. Firepower forces will be fully equipped, manned, and trained to achieve firepower dominance. The objective is assured defeat of the enemy. These weapons and their support will be predeployed or rapidly deployable to distant battlefields and will possess the capability to reposition tactically. They will have sufficient range to provide for the rapid concentration of firepower while operating from dispersed positions or bases and will possess the lethality and accuracy to destroy the targets that they are to attack. The weapons, in aggregate, will provide a range of conventional, nuclear, and chemical options, and all planning for employment of the weapons will facilitate the shift from one option to the other. Although not firepower per se, offensive electronic warfare means will be treated as weapons and integrated into battle plans as such.

These principles provide the foundation for the FIDO concept. It is not intended that this concept be constrained to the Central European battlefield, since one of its objectives is to enhance the worldwide projection of military power. However, it is useful to describe the concept in terms of a major NATO-Warsaw Pact confrontation so that the reader can relate it to a relatively familiar scenario. Force structure changes will be addressed first so that the reader can better understand the subsequent discussion covering the flow of battle.

To achieve full firepower dominance, extensive changes to force structure would be required. First, firepower, RISTA, C^3, and other related resources would be greatly increased in quantitative and qualitative terms. Concomitantly, quantitative requirements for maneuver forces would be considerably lower on any given battlefield. Since this last statement strikes the soldier where it hurts most, I will discuss this area before describing firepower changes.

Maneuver force requirements on the FIDO battlefield would consist of a fairly heavy covering force forward deployed along the entire battlefront and highly mobile main forces deployed in depth at strategic locations. The primary purpose of the covering force would be to cause the Warsaw Pact first echelon to deploy and help channel it into firepower killing zones. The division-sized mobile main forces would maintain dispersed (but combat ready) postures at their base locations, prepared to execute missions that include reinforcement of the covering force, destruction of isolated enemy elements that eluded firepower annihilation, and consolidation of terrain cleared by firepower. Both the covering and main forces would be organized and equipped to provide the mobility necessary for rapid concentration

and deconcentration. Integral firepower would be designed to kill armored vehicles at maximum standoff ranges during highly mobile engagements. Attack helicopters could provide augmentation to integral firepower while other helicopters might be employed to maintain the flow of logistics, deploy mines, and emplace antitank guided missile teams. Since maneuver forces would not be the primary means for stopping and destroying the enemy, it is expected that the number required on the battlefield by current doctrine could be cut at least in half. However, the remaining maneuver forces would have to be of top quality.

Firepower forces, in contrast to maneuver forces, would grow in size and quality to meet the demands of firepower dominance. The doctrinal concepts that would serve as a guide for firepower employment and force structure requirements are similar to those used for building and employing tactical air forces.[13] The primary functional missions would be *maneuver force destruction, offensive and defensive counterfirepower, and interdictory firepower.* The apportionment of firepower for each functional mission would depend on the objectives to be achieved and the overall situation. To provide this apportionment flexibility, a full range of multirole air and land firepower systems must be made available to commanders. These systems must be suitable for strategic deployment so that military firepower can be projected to new battlefields or can provide rapid reinforcement in Europe. To the maximum extent possible, the systems must be night, obscured-conditions, and adverse-weather capable and able to deliver concentrated firepower while operating from dispersed positions or bases. Besides tactical aircraft, which will be needed in great numbers, it is visualized that firepower systems could include surface-to-surface missiles, long-range single/multiple rockets, air defense guns/missiles, attack-capable ground-launched cruise missiles, and extended range artillery. Greatly enhanced capabilities for electronic warfare would be integrated with firepower means. Ground-based firepower systems and all ground/air support elements should be fully mobile. Precision and area munitions capable of defeating hard and soft targets would be required. These munitions should provide for a full range of conventional, nuclear, and chemical options. Although some suitable weapons and munitions are available, it is quickly recognized that extensive research, development, test, and evaluation/production efforts would have to take place to field the quantity and quality needed for assured firepower dominance.

Similar efforts would be necessary to develop the required reconnaissance, intelligence gathering, surveillance, and target acquisition capabilities. It is visualized that the systems providing these capabilities would also operate from dispersed positions or bases and provide real-time targeting/assessment information around-the-clock, in any obscurant and weather conditions. Force structure emphasis should be placed on providing large numbers of standoff and penetration systems that are reliable and relatively survivable but sufficiently inexpensive to allow continuous saturation of the battlefield. The systems and their support elements should be able to operate on a mobile positioning/basing concept.

To tie the functional elements of a FIDO-based force structure together and provide the survivable links necessary for flexible centralized command and control, an extensive effort must take place to develop a very sophisticated C^3 system. Not only must the C^3 system elements be dispersed, protected, and shielded from damage by enemy firepower, the system must be able to continue operations in chemical, nuclear, and electronic warfare environments. Ideally, advances in fiber optics, microcomputerization, space communications, and other related

technologies would be applied to develop a redundant multiple route/media network with multiple user access points spread throughout the battlefield. The command and control nodes, which would also provide firepower integration, could then be mobile and plug into the system at any access point. However the C^3 system is established, its ability to remain fully operational throughout the battle is absolutely crucial to success.

Logistical forces would have to be highly flexible and, similar to the combat forces, would have to concentrate and deconcentrate logistical support rapidly from dispersed locations. To facilitate this, war materials and logistical manpower should be organized in packages that are strategically positioned to meet the expected flow of battle. Reserve war materials should be located so that they could be used in response to deviations from the predicted battle flow. Everything considered, logistics support may be simpler than under current doctrine due to the centralization of command and control and the reduction of maneuver forces.

Undoubtedly, numerous other force structure changes would have to take place to make the concept work.

The Flow of Battle

Discussion of the firepower dominance concept as employed during the flow of battle will be kept on the abstract level since it is primarily intended to summarize the application of the firepower dominance theory. The NATO-Warsaw Pact scenario will be used for the sake of convenience.

Warning of a Warsaw Pact attack would come from both strategic national intelligence and battlefield RISTA resources. Since, under the FIDO concept, the NATO RISTA resources would already be continuously oriented against the Warsaw Pact forces, assessment and targeting would already be in progress. At the first act of aggression and with subsequent political approval to defend against the enemy, extensive preplanned cross-boundary RISTA operations would start. The FIDO concept would most likely be no secret to Warsaw Pact military planners, and measures would undoubtedly be taken to destroy NATO RISTA capabilities. Deception measures could also be expected and might include attempts to conceal force concentrations or to avoid force concentrations until the last possible point in time.

Nevertheless, if the RISTA effort is properly executed, it should lead to a reasonably clear picture of the Warsaw Pact first echelon maneuver formations across the entire front. As the leading elements move beyond the political boundary, the NATO covering forces would engage them to force their battle deployment, channel them into firepower killing zones, and develop refined targeting information. The mobile main forces would be deployed in depth, ready to concentrate when and where needed.

Enemy first echelon targets would promptly be attacked with intense air and ground maneuver force destruction firepower. Concurrently, firepower means supporting the first echelon would also be heavily hit. The objectives would be to destroy first echelon maneuver forces before they could penetrate or be reinforced, strip away their fire support means, and cause the maximum possible initial psychological impact.

Defensive counterfirepower assets, consisting of an extensive network of ground-based air defense systems and a relatively small number of interceptor aircraft, would meet the expected waves of Soviet Frontal Aviation aircraft. The dispersal of NATO forces would compound the targeting problem for the enemy and, it is hoped, reduce the effectiveness of those aircraft that are able to penetrate.

Offensive counterfirepower operations

would be put into effect immediately at the start of battle to reduce Warsaw Pact air power and long-range land-based firepower to an ineffective level. Tactical aircraft and surface-to-surface missile attacks would be made against airfields, aircraft support facilities, C^3 nodes, missile sites, and nuclear weapon systems. Offensive counterfirepower initial objectives would be to establish air superiority, suppress or destroy long-range ground-based firepower capabilities, and destroy nuclear-capable weapon systems.

Although some firepower would be placed against second echelon maneuver forces and interdiction targets in the initial stages, the bulk of NATO firepower would be devoted to air defense, first echelon maneuver force destruction, and offensive counterfirepower operations. The weight of effort in these areas would continue until it is determined that the primary objectives have been met. At that time, the priority would shift by stages to provide for the systematic destruction of second echelon forces, interdiction targets, and Warsaw Pact reserves.

Throughout the battle, NATO battle managers would follow the principles of firepower dominance, dispersal, rapid concentration/deconcentration, RISTA saturation, centralized C^3, and flexible weapons employment. They would use timed pulses of firepower to meet the enemy at his points of strength and, early in the battle, take away his advantages of surprise and offensive initiative. Stripped of his offensive firepower and without sufficient maneuver forces to continue the attack, he would have no recourse but to retreat from the battlefield.

Analysis

Any concept has particular strengths and weaknesses, and the FIDO concept is no exception. Because the concept has been presented in the abstract, the analysis must take place at the same level: a simple presentation of major disadvantages and advantages.

Several disadvantages can readily be identified. First, adoption of the concept would appear to be very costly because it would require a high density of technology-intensive firepower, RISTA, and C^3 systems. It is hoped that a large portion of this cost would be offset by the reduction of maneuver forces, decreased overseas stationing requirements, and allied cost sharing. Second, the concept is dependent on a centralized C^3 network that may be fragile and susceptible to degradation. This is a legitimate concern. However, even with the current concept of warfare, such a system is needed. At least with the new concept, a great emphasis will be placed on making it work. Finally, if the FIDO concept were to fail in battle, then insufficient ground maneuver forces would be available to hold the enemy. To answer this, several points can be made. First, it is not clear that the maneuver forces currently in place could resist a superior Warsaw Pact onslaught even if reinforced. If they failed to do so, not only would the battle be lost but so would a major portion of our Army. On the other hand, the bulk of the FIDO firepower forces (especially the aircraft) would have the mobility to withdraw strategically.

The advantages of the FIDO concept are numerous, but I will limit my discussion to just a few. First, by adopting the concept, the United States would be able to put new meaning into the flexible response strategy. As befits a maritime nation, military power could be projected worldwide in the form of relatively mobile firepower systems that are not dependent on large, manpower-intensive ground maneuver forces. This reduction of maneuver forces and their deployment requirements could reduce the existing strategic mobility problem, balance-of-payment problems, and the need for large standing manpower requirements during peacetime. Second, the FIDO concept facilitates a fully integrated preparedness and capability to

fight chemical and nuclear warfare. Third, it provides the capability to quickly resolve the outcome of a battle and do it before the battle moves deep into friendly territory. Fourth, the concept forces a joint approach toward battle and firmly establishes doctrinal interfaces among the various services. Finally, the concept is readily adaptable to the acceptance of new technology and presents an opportunity for the United States to regain unquestioned superiority in this area.

I am sure that the reader can find other advantages and disadvantages, or may disagree with some that I have presented. I can also see where some may have great difficulty in accepting a concept that implies that the tank is obsolete, among other things. Obviously, an in-depth analysis would be necessary to identify specific weaknesses and strengths of the concept and to prove that it would really work.

WHETHER one agrees or disagrees with the FIDO concept, it presents a clear alternative to the traditional model for land warfare. It recognizes that firepower is the dominant force which leads to the destruction of the enemy on the battlefield and is a logical extension of trends and developments that are available for all to see.

Until the concept is thoroughly analyzed to determine if it is viable, it can be considered no more than one man's opinion of how modern war should be fought. I hope that this article may spur others to test that opinion and see if it bears fruit.

Air War College

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A RESPONSE

LIEUTENANT COLONEL DENNIS M. DREW

WHEN one's job is to encourage creative thinking about strategy and doctrine, it becomes difficult to criticize innovative efforts in these areas. There is always the nagging fear that criticism will stifle further creativity. Most creative efforts, however, can be constructively critiqued. We hope that this dialectic process will bring us closer to the truth—closer to the most appropriate strategy and doctrine.

It seems to me that Lieutenant Colonel Fairweather's "new model for land warfare" can be challenged on two levels. The first is contextual; that is, the situation that spawned the "new model." The second level of

challenge is conceptual; that is, problems within the "new model." Each challenge will be treated in turn.

context

The "new model" is, essentially, another in a seemingly endless series of "how to" or "how not to" fight a war in Europe articles that have appeared in the literature over the past few years. To Colonel Fairweather's credit, he has avoided the two most common themes of other authors: i.e., "bean counting" forces and debating the wisdom of forward defense. Colonel Fairweather has, however, repeated the fundamental error of his contemporaries, which can best be described as intellectual timidity. Nearly all authors can offer constructive criticism concerning "how to" fight in Europe, but seldom does anyone ask "should we" fight in Europe. Although Colonel Fairweather indicates that his "new model" is not constrained to a European scenario, it is difficult to imagine the "new model" at work in very different environments with very different adversaries. Thus the "should we" question remains appropriate.

To ask "should we" fight in Europe is to challenge the basic assumptions of our foreign and military policy. Unfortunately for those settled in their thinking, these assumptions are 30 years old and worthy of challenge. We must remember that the original purpose of a U.S. military commitment to NATO was to provide the security and stability that would promote European postwar recovery and return our Western Allies to a condition of self-reliance.

Obviously, the situation today is very different. The primary reason given for our continued commitment is that the huge industrial plant and large, highly trained population of Western Europe cannot be allowed to fall under Soviet domination. But are these not the very reasons that Europe should be militarily self-sufficient? Do we not have other national interests abroad that, at the very least, rival the importance of Western Europe? These questions cannot be adequately addressed here. The point is, however, that these questions must be faced. If it happens that our most vital interests lie outside Europe, we may need a total restructuring of our armed forces, not just a "new model" for land warfare.

The assumptions of the past must be continually challenged if they are to continue as the foundation of our defense policies. Strategy must be based on reality, not our memories of the past or our illusions of the present. Unfortunately, the basic assumptions are rarely challenged. It is, of course, entirely possible that even if we challenge these assumptions the defense of Western Europe may remain as the most vital U.S. national interest. In this light, it is appropriate to critique Colonel Fairweather's ideas on a conceptual basis.

concept

Rather than a "new model," it looks as though Colonel Fairweather has taken his cue from Detroit and simply rearranged the chrome on last year's model. Still envisioned is a defense best characterized as employing the "direct" approach. Field Manual 100-5[1] calls for moving mobile forces directly into the path of the enemy thrust, to force a decision in a cataclysmic battle of firepower.* The implication is that the decision is forced at relatively close quarters. The "new model" projects the same type of decisive battle but with supporting firepower in the dominant role while mobile forces simply channel the enemy thrust into predetermined "killing grounds." The "new model" is the "old

*The term *mobile forces* is used carefully. To use the term *maneuver forces* for this type of operation is to bastardize the meaning of the term *maneuver*.

model" at arms length. Regardless of the model, one is reminded of the mutual slaughter at Verdun in 1916.[2]

The outline of the "new model" presents many problems, some of which are forthrightly addressed by Colonel Fairweather. Others, unfortunately, are not addressed. For example, can RISTA (reconnaissance, intelligence gathering, surveillance, and target acquisition) be as effective as projected and required? If mobile (maneuver, if you insist) forces are greatly reduced, how can they channel the enemy attack to the support fire "killing grounds"? Is counterattack foreclosed because of the great reduction in mobile/maneuver forces? These, however, are problems in detail. The conceptual problem is much more vexing. Whether it is the "new model" or the "old model," the direct approach to defense has dubious prospects for success. Both models pit strength against strength. This is analogous to a boxer counting a haymaker punch by attempting to hit his opponent's fist with his own crushing blow. The best that can be expected from this sort of exchange is two broken hands. The smart boxer avoids the enemy haymaker and attacks the opponent's critical vulnerabilities, such as the head or belly. This is the essence of maneuver; this is the indirect approach, pitting strength against weakness.[3]

Colonel Fairweather does discuss the problem of expense in purchasing the vast array of equipment needed in the "new model." However, he all-too-easily solves this problem by reducing the expenditures for mobile/maneuver forces. This "rob Peter and pay Paul" solution ignores the fact that the "new model" still gives mobile/maneuver forces a significant role, and they still require significant strength and expenditures. When developing new ideas, one must recognize reality. We must not look at the panoply of available equipment through the eyes of a child clutching a credit card in a toy store. Observing reality is one of the basic principles of strategy.

The most troublesome conceptual problem, however, lies elsewhere, but it also concerns the principle of reality. We must recognize that strategy is a two-actor situation. We must always consider enemy actions and reactions realistically. Unfortunately, one gets the impression that Colonel Fairweather has underestimated the enemy. It is highly doubtful that Warsaw Pact forces will stage a variation of Pickett's charge at Gettysburg, mindlessly and continuously advancing into convenient "killing grounds" inviting their own destruction. One must assume that any attack will be accompanied by measures to disrupt our communications, confuse our intelligence, and limit our mobility. All of this will limit the "new model's" ability to concentrate and disperse, thus disrupting the required "pulses" of firepower. We face a wily foe, well schooled in military history and bent on profiting from history's "lessons." We must consider our opponents realistically.

ANY new strategy must be developed within the proper context. This means that rather than enter the argument at the level of military or battlefield strategy, we must always look at the entire strategy process.[4] We must challenge basic assumptions so that national objectives are pertinent and well understood. We must know what we have been tasked to do, in terms of grand strategy, to achieve those national objectives. Only then can we effectively develop military and battlefield strategy.

Yet, working through the strategy process is not sufficient. At the very least, we must be ruthless in observing reality. We must recognize the realities and limitations of economics and their impact upon materiel. Most important, however, we must recognize the realities of the enemy we face. The Soviets and their allies are not ten-feet tall, and they

are not military geniuses. Neither are they physical and mental midgets.

I congratulate Colonel Fairweather on a significant contribution to a strategy dialogue that must continue. Although I have been critical, one must remember that everything written on the subject (including this short article) should be closely critiqued. Only if this dialectic process continues can we expect to cope effectively with a rapidly changing and increasingly dangerous world.

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Notes

1. Refer in particular to page 3-6 of FM 100-5.
2. Verdun may be the classic example of what happens when strength is pitted against strength in modern warfare. Perhaps the finest account of this battle is Alistair Horne's *The Price of Glory* (St. Martin's Press, 1962, and also available in a Penguin Books paperback edition).
3. As always, the best reference for the "indirect approach" is the originator of the phrase, Sir Basil Liddell Hart. See in particular his *Strategy* (Faber & Faber, 1967, also available in a Signet paperback); specifically, see chapter 20.
4. See "Strategy: Process and Principles" by Lieutenant Colonel Dennis M. Drew in *Air University Review*, May-June 1980. This article stresses the required linkage between the various levels of strategy, thus emphasizing the importance of the entire strategy process and the folly of separating military strategy from national objectives.

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A RESPONSE

MAJOR JAMES M. SIMPSON

THE major problem I encounter in commenting on Lieutenant Colonel Robert S. Fairweather's proposal for revising doctrine in "A New Model for Land Warfare: The Firepower Dominance Concept" is that, fundamentally, it is not a new doctrine at all. The author says as much when he traces its antecedents to current second echelon interdiction concepts. The proposal is thus open to the criticisms raised in the numerous debates about current U.S. doctrine that have appeared in these pages and elsewhere, as well as more fundamental questions raised by the FIDO concept itself.

In general, the new approach reinforces rather than changes the established U.S. doctrinal approach to land warfare. It is clearly a firepower/attrition doctrine at the expense of mobility and maneuver. Its sole purpose is the destruction of the enemy's armed forces from a purely defensive posture. Despite Colonel Fairweather's reference to his indebtedness to guerrilla, blitzkrieg, and other mobile warfare concepts, he clearly remains well within the American tradition of the direct approach aimed ultimately at the physical destruction of the enemy.[1] In this context it should also be clear that his use of the term *maneuver* refers more to the mobility of forces rather than *maneuver* in the classic sense, which is designed to gain strategic or tactical advantage. Thus the reduction he calls for in maneuver forces seems to push the proposed doctrine even further toward a static firepower/attrition position than does the current approach.

In addition, the proposal does nothing to alter most current doctrinal assumptions, particularly in the European theater. Indeed, despite his claims to the contrary, the proposal seems tailored to the specific, purely defensive posture of that theater. The politi-

cal-military objective is still to erect a defensive wall against the potential aggressor, which will result in his withdrawal with a minimum loss of allied territory either destroyed or given up in the process. The specific military objective is still to destroy the main mass of forces in the enemy's offensive thrust. The model assumes a head-on confrontation in the popularized mold of the Napoleonic "decisive battle" with little attendant strategic or tactical subtlety.

Beyond these general objections, however, it appears that Colonel Fairweather had placed too much one-sided faith in a number of current trends that he and others have postulated for the modern battlefield. Instead of devising a doctrine that will lead technology, he has allowed his analysis to be driven by technological factors almost exclusively.

Colonel Fairweather is not the first to note the increased lethality of the modern battlefield; however, by joining those who see the tank as obsolescent, he ignores the conclusion of two major proponents of combined arms, Israel and the Soviet Union. Both have concluded that, used properly, the tank is still an important element of both firepower and maneuver. The demise of the tank may not take as long as that of the armored cavalry in the Middle Ages, yet to forge a doctrine around the assumption that it has already occurred is to place too much credence in the first few days of the 1973 Arab-Israeli War and not enough to its closing episodes. In this he shares overoptimism with proponents of current second echelon interdiction concepts.

Even more sanguine, however, is the faith the author places in the capability of technology to "potentially eliminate many of the 'mysteries' of war." (p. 80) I distrust this assumption for two reasons. First, if he has not overestimated the technological capability to acquire the required information, he has certainly assumed uncontested access to the visual, near-visual, and electromagnetic spectrums both to "see" the enemy and transmit the results in anything close to real time. Second, and perhaps even more important, is the assumption that by seeing the dispositions and movements of the enemy one can deduce his assumptions. Deception is as much an integral part of the tactics and strategy of warfare as it is on Saturday or Sunday football.

The author's conclusions as to the trend evident in our ability to centralize command, control, and communications (C^3) fall into this same category. But here, by his own admission, "However the C^3 system is established, its ability to remain fully operational throughout the battle is absolutely crucial to success." (p. 85) Thus, the point just alluded to can be reemphasized more forcefully. There seems to be a tacit assumption that the United States can retain a favorable technological edge in controlling the visual and electromagnetic spectrums to our unilateral advantage while denying a comparable capability to the enemy. This assumption appears to include both spectrums themselves as well as the associated ground equipment. In fact, experience shows that both spectrums are more neutrally available to the side which best mixes technology, quantity of existing equipment, and trained skill in application. This relationship has historically been one of relative advantage between sides which change over time. It is much more subject to a Boyd timing and tempo analysis than it is to computing an absolute advantage across-the-board and maintaining it. Simply postulating the importance of electronic warfare as a "whole new field of military endeavor" ignores this fact as well as the existing Soviet doctrine, force structure, and trained personnel engaged in Radio Electronic Combat (REC). Thus Colonel Fairweather's conclusion that "Presumably, the electronic warfare advantage falls to the side able to field technologically superior

equipment" may emerge more as a hope than as a practical assumption. (p. 80)

Finally, the conclusion that these and other new technologies have promoted a desire to stabilize the battlefield seems to lean too heavily on the Egyptian reluctance to move out from under fixed defenses set up for the 1973 War and to pay too little attention to the offensive doctrine and associated force structure exhibited by the Soviets. If the increase in mobile defensive systems of all types assigned to Soviet divisions, all of which are mechanized, is not an indication that at least they do not accept such a technologically stabilized battlefield, then many analysts have missed the mark. To adopt the assumptions of the static defense in ascendancy over the offense, as seen in World War I, or of a maginot line philosophy in the face of an enemy, which is overtly dedicated to an offensive orientation that emphasizes both mass and maneuver, seems to be one of an excessive faith in technological solutions.

Compounding what seem to me weaknesses in the analysis of current trends is the tendency to which I alluded earlier, namely assuming that these benefits are one-sided. What convinces the author that if we can see the enemy, the enemy cannot at the same time see and target us? What persuades him that our firepower assets, C^3 nodes, and so on are not equally vulnerable to attack and disruption as we assume the enemy's to be? What convinces him that we will dominate a technology merely by doctrinally deciding that it is important?

I must reemphasize that this proposal advocates a doctrine which is even more purely committed to an exclusively defensive posture than that which it replaces. Presumably, this is done on the assumption that force ratios and technological trends favor such an orientation; however, establishing a general set of doctrinal principles which largely ignores the offensive seems to introduce a dangerous rigidity. To express further the expectation that the force changes required by this approach will result in a cheaper defense is unsubstantiated. The assumption that many of these technological trends are already required by current doctrine and, therefore, the proposed approach only commits us to them more definitely is both specious logic and an unnecessary limiting of doctrinal thinking to that which is purely firepower/attrition.

Thus, the article proposes neither really new doctrine nor even a practical alternative to that which currently guides our efforts. It appears to rest on rather optimistic conclusions surrounding technological initiatives already under development as well as a total lack of reaction to these same realities on the part of Soviet doctrine and forces.

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Notes

1. See Russell F. Weigley, *The American Way of War* (New York: Macmillan, 1973), for a development of this thesis. In addition, a number of recent articles contrast the American direct approach to the indirect approach. See Colin S. Gray, "The Military Requirements of US Strategy," *Military Review*, September 1979; William S. Lind, "Military Doctrine, Force Structure, and the Defense Decision-Making Process." *Air University Review*, May-June 1979; and Edward N. Luttwak, "The American Style of Warfare and the Military Balance," *Air Force*, August 1979.

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military affairs abroad

A TRANSPARENT FIGLEAF

the offensive nature of Soviet military doctrine

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RECENT events in Afghanistan have caused Western analysts to reflect on Soviet intentions worldwide, especially as manifested against NATO. This analysis deals with the goals and aims of Soviet foreign policy in general terms and with both the contents and development of the defensive and offensive way of thinking in Soviet military doctrine. This has been done as a basis for further analyses and evaluations of Soviet actions and probable intentions in the future.

Soviet Foreign Policy

The foreign policy of the Soviet Union as well as that of the Warsaw Pact countries is based on the concept of peaceful coexistence. By means of peaceful coexistence of countries with different social and political systems, Soviet theory

states that a "specific form of the class struggle between socialism and capitalism"[1] can be made possible on the international level.

While peaceful competition between the systems is aspired to in the political, economic, and social spheres, ideological coexistence is explicitly excluded from this competition, as the "sphere of ideology . . . has become the front-line in the battleground of the most severe ideological conflict."[2]

In Marxist-Leninist terms, peaceful coexistence has two components: cooperation ("peaceful competition of the system") and confrontation ("the specific form of the class struggle"). Thus, peaceful coexistence is intended to sustain the socialist revolution in countries of the capitalist world and to create preconditions favorable for victory. This is the main task of Soviet "socialist foreign policy." The Soviet Union, as the leading power of the East European states, coordinates this socialist foreign policy between all Warsaw Pact countries by using the centralistic structure of the Warsaw Pact organization as the "main center of coordination," for instance, the meetings of the Political Consultative Committee, Council of Foreign Ministers, and Council of Defense Ministers. There the Soviet Union cracks the political and ideological whip, a clear manifestation of her hegemony, based mainly on her vastly superior military strength. Her forces in most Warsaw Pact countries have a dual function: to ensure conformity and to hold the Pact together. Thus, there is a clear interconnection between Soviet foreign policy and Soviet military policy. Both are identical in long-term goals, such as the creation of favorable preconditions for victory, but differ in their implementation. Military policy deals with terms of protection, safeguarding, and the realization of the interests of the Communist Party of the Soviet Union. These interests, measures, and tasks are defined in the military program and in military doctrine.

Analyses of speeches made by leading politicians and military men of the Soviet Union and Warsaw Pact countries demonstrate clearly that, on the one hand, peaceful coexistence eliminates the doctrine of the "unavoidability of war"; but that, on the other hand, it does not exclude armed conflict as the most extreme form of class struggle. Class struggle does not necessarily have to result in war; for the stronger socialism becomes, the less cause there will be for overcoming capitalism by means of wars.

This ambiguity is the underlying reason for the problem experienced by most Western analysts trying to understand Soviet attitudes, as evidenced in debates concerning the military potential and military doctrine of the Warsaw Pact countries. Clearly, the correct assessment and consideration of both these aspects are of vital importance to the West—and not only with regard to Western policies concerning security and defense.

By means of carefully directed agitation and propaganda, controlled by the Soviet Union, and by overemphasizing their desire to cooperate, the aspect of confrontation is played down to the point where it is virtually imperceptible. It is significant, nevertheless, that this aspect of Soviet doctrine is never explicitly denied.

Soviet Military Doctrine

Soviet military doctrine has its origin in Marxism-Leninism—the doctrine of reshaping the world by revolution—and is considered to be a system of fundamental views on the preparation for and conduct of war. During and after the October Revolution and the civil war, Lenin formulated the lessons formed from experience gained concerning the structure and deployment of the army. He then catalogued these findings and adopted them as principles. They were sub-

sequently laid down as the fundamentals of Soviet military doctrine. These are, inter alia, control of the armed forces by the Communist Party, class approach in the organization of the armed forces, centralization of military command, and allegiance to proletarian internationalism.

The Party and military commanders were given the joint task of preparing a military potential that would not only guarantee security but would also assist in achieving the aims of foreign policy. Military doctrine and strategy are thus closely linked with political objectives.

The transformation and realization of Lenin's principles led to obligatory views on the character, preparation, and conduct of war. In accordance with the orthodox doctrine of war as outlined above, Soviet military doctrine recognizes three types of war:

(1) Military aggressions caused by the policies of "imperialism" force the class struggle to assume the military form of war between the "camp of imperialism" and the "camp of socialism."

(2) The camp of socialism then wages "just war," as the annihilation of imperialism is one goal of the revolutionary workers' movement. Furthermore, national wars of liberation and wars of revolution are considered to be "just" wars.[3]

(3) "Imperialist wars" are, therefore, "unjust wars," as they are conducted as "wars of conquest by a public enemy."[4]

At present, Marxist-Leninist military science considers that basically two main categories of war between countries of the two opposing social systems are possible: worldwide nuclear war[5] and limited war without deployment of nuclear arms.[6]

Regardless of the distinctions made between these main categories, Soviet soldiers are prepared and trained for both types of war. In the Soviet Communist view, it is considered probable that a limited war without deployment of nuclear arms would be expanded into a worldwide nuclear war. The Soviets believe that the uncompromising ruthlessness by which war, as a decisive class struggle between socialism and imperialism, must be waged, as well as the determination to reach political objectives, will eventually force one side into deploying its entire military potential.

The principle of this military doctrine contains both political and military components and demonstrates their inseparable and organic connection within Soviet military policy. The pronounced class-conscious nature of Soviet military doctrine in the political sphere—and this is still completely valid today—supplies this doctrine with strong, unmistakable offensive characteristics aimed at the opponents of socialism. Class struggle, the consequence of the antagonism of the classes between the two systems, is inevitable. The policy of détente neither cancels nor alters the laws of the class struggle.

In the Communist view, imperialism has no future in its historic conflict with socialism. Imperialism cannot arrest this historical process by either peaceful or military means. The process will inevitably lead to the victory of socialism. This belief also constitutes an essential factor in the Soviet soldier's conviction that he will be victorious.

According to the doctrine of war ("just" and "unjust" wars), the opponent of the socialist system is always responsible for the outbreak of the war. Viewed from a military standpoint, military doctrine is the result of a process of development of political ideas that will achieve solutions to military problems and assumes concrete application in military strategy. It is geared to war and includes the following main factors: surprise attack on the enemy, securing and maintaining the initiative from the outset, strategic attack, swift and purposeful operations, and complete destruction of the enemy in his own territory.

importance and implications

After the civil war of 1917-19 and the warding off of foreign intervention in 1919-20, the stabilization of Soviet power required concentrating all its energies on the consolidation of its internal system. At the same time, provisions had to be made for defense against further impending military dangers from outside. At that time, military doctrine, in the absence of a strong potential in the military area, naturally possessed predominantly defensive features.

The first signs of a reorganization of the military contents of military doctrine, caused by a change in military strategy, emerged increasingly from 1936 onward. This change consisted of an increased use of tanks in combat-effective formations for offensive action. According to the Field Service Regulations of 1936, tank units "by making use of their speed and impetus should penetrate deep into enemy territory and pave the way for the infantry following them."[7]

For the Soviet Union, the Second World War began with the German surprise attack that resulted in heavy losses and serious destruction on Soviet territory.

In the second phase of the war, the application and efficient mastery of these new requirements of military strategy brought about Soviet successes. By concentrating all efforts on the current main thrust, the Soviet attack on various fronts was led by powerful tank units in large-scale operations.

By mid-1943, the Soviet tank corps had become the main force in the Soviet ground forces. In the Battle of Kursk (July 1943),

> all five tank armies existing at the time as well as 15 armored or mechanized corps were brought into action, as well as additional independent armored brigades or regiments. This was certainly the decisive battle in the Second World War: it lasted for approximately 50 days over an extent of 500-600 kilometers. After this battle, Germany was never again able to begin a major offensive.[8]

From 1943 on, the Soviet Air Force, too, underwent basic changes, such as the integration of the small squadrons of battle planes and bombers that formerly fought in isolation. Within the framework of an air offensive, a "massive strategic and tactical use of airplanes" took place, "closely coordinated with the operations of the ground forces."[9] This concentrated employment of the air combat forces took place with up to 90 percent of disposable forces engaged in the direction of the main thrust, thus enabling the tank armies to penetrate deeply into enemy lines.[10]

At the end of the war, buffer zones necessary for the protection of the Soviet heartland under the conditions of a conventional war were established and enlarged (Manchuria, the Baltic States, Finland, and the Warsaw Pact countries). The Soviet Union had gained 275,000 square miles with 24.5 million inhabitants.

After 1945, the Soviet Union was faced with a new problem in that only the West possessed nuclear capabilities. This lack of weapon technology for equivalent strategic possibilities was reflected in the military orientation of Soviet military doctrine and strategy, even in the main theater of war. In its main thrust, at first, the doctrine for operational command provided for defense by accepting territorial losses at the beginning of a war, followed by a change to an offensive after having been reinforced by a supply of additional troops from deep inside the Soviet heartland. But, as the Soviets gained first nuclear and then thermonuclear capabilities, doctrine changed. Along with mounting Soviet nuclear armament, the demands on military strategy increasingly moved toward the direction of offensives right from the outset of hostilities.

This has been the basis of Soviet military doctrine since the beginning of the 1960s; it is still valid today.

THIS glance at history demonstrates that, from the October Revolu-

tion until the present day, Soviet military doctrine, in the political arena, has adhered doctrinally to the principle of Marxist-Leninist teachings within the framework of the class struggle. During the period of détente, the offensive nature of these policies was neither curtailed nor abandoned.

In 1975, Marshal of the Soviet Union Andrei Grechko, the former Defense Minister of the Soviet Union, summarized the essential elements of this military doctrine in the following words:

> As we know, . . . military doctrine is understood to be an officially accepted system of views in a given state and in its Armed Forces on the nature of war and methods of conducting it and on preparation of the country and army for war. The entire content of Soviet military doctrine can be divided into two interconnected groups of questions—political and military. The political content of Soviet military doctrine stems from the socialist system of the USSR, from the policy of the Communist Party and Soviet State, and from the fundamental interests of the Soviet people.
>
> . . . With regard to the military content of Soviet military doctrine, . . . [the] Ideas of activeness of offensive and defensive operations, and of resolute and total defeat of an enemy permeate the entire development of the Soviet Armed Forces—their technical equipping, organizations and methods of training and educating personnel. . . .[11]

The military component of military doctrine changed with the strategic and military potentialities of the Soviet Union. In the course of continuing development, the structures of the Soviet armed forces, inclusive of the utilization of the military potential available in the Warsaw Pact countries, were increasingly and unmistakably adjusted to meet the demands of offensive objectives in strategic dimensions. Soviet military literature published in the West reveals this without a shadow of a doubt.

According to this literature, Soviet forces must at all times be capable of hitting the enemy hard, especially at the beginning of a war. This requires a continually high state of combat readiness on the part of all troops and staffs. The goal is to cause the enemy to sustain heavy losses by smashing his main forces and nuclear weapons, annihilating strategic industrial plants, and destroying the political and military command system.

In doing so, favorable conditions are created for a subsequent attack. Thus, the first few hours of a war are of the utmost significance for victory. At the same time the Soviet Union's own losses are reduced to a minimum. The strategic offensive is the basis of all Soviet operations. Technical improvement and continuous development of the conventional armed forces serve to strengthen offensive capabilities. The Soviet leadership's only concern is to win, not to deter. Victory can only be achieved by total destruction of the enemy's armed forces. Consequently, maintaining the classical strategy of destruction remains an integral part of Soviet military strategy, even in the atomic age, and it demonstrates the offensive character of the Soviet conduct of war.

Mindful of the impact of a surprise attack on the Soviet Union during the Second World War, the Soviets will never again let their territory be the place where war is waged. The principle of not permitting the Soviet Union to be the object of a surprise attack and of retaining the initiative from the outset contains within it a preemptive option.

Western experts agree on the conventional military supremacy of the Warsaw Pact in Europe.

> In spite of détente, the Soviet Union has intensified her re-armament efforts during the past 10 years. From the principle of offence of Soviet military strategy and the structures and potentials derived therefrom, we must conclude that, in the case of war, her armed forces will be deployed offensively.[12]

The Soviet armed forces are also attempting to establish quantitative superiority in the area of strategic nuclear warfare by introducing new weapons.

A concerted threat of war, however, cannot be established solely by the offensive struc-

ture of the armed forces or by military and strategic capabilities. Rather, this depends on political intentions.

For the Soviet leadership, military force represents the only means to carry out its political aims. The West can employ the economy as an additional instrument of power. Thus, military instruments are of absolutely vital importance for the Kremlin. By means of the totality of the desired military supremacy, political pressure can be intensified in order to acquire the positional gains desired.

The justified fear in the West—the myth of the Soviet threat—is supposed to be defused by statements and propaganda actions of Soviet politicians. With half-truths and dishonest methods, they have already succeeded in some Western circles in creating the impression of a credible Soviet love for peace. However, the reality of the Soviet love for peace has been severely challenged by recent events in Afghanistan. Moreover, this case reveals that the Soviets use the same military methods both against states that are considered their enemies and those which are their friends.

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Notes

1. *DDR-Hanbuch,* Cologne, 1975, p. 338.
2. Ibid.
3. Just wars are above all those that agree in their political objectives with the interests of the revolutionary working class and which also contribute to the shifting of the international balance of power toward socialism.
4. In such a war, imperialism, by continuing its aggressive policies, would destroy socialism politically and militarily. Its objective is the destruction of all revolutionary and anti-imperialistic movements, in order to regain its individual position of power in the world.
5. A worldwide nuclear war can result in unlimited deployment of all available nuclear weapons. In the Soviet view, the decision as to whether to deploy nuclear arms must be examined and made at the beginning of a war. It cannot be ruled out that the war may also be a long one and that it may be continued with conventional weapons.
6. In a limited war without deployment of nuclear arms, the transition to a nuclear war is possible at any moment.
7. E. Sobik, "Sowjetische Panzertruppe," Part I, in *Truppenpraxis,* November 1978, p. 869.
8. E. Sobik, "Sowjetische Panzertruppe," Part II, in *Truppenpraxis,* December 1978, p. 959.
9. H. J. Barakling, "Die Sowjetische 16. Frontluftarmee 1942-1945," in *Truppenpraxis,* February 1978, p. 145.
10. Ibid., p. 146.
11. A. A. Grechko, *The Armed Forces of the Soviet State: A Soviet View* (Washington: Government Printing Office, 1975), pp. 272-75.
12. Dr. Hans Apel, Defense Minister of the Federal Republic of Germany, in his speech on 4 May 1979, Borkum Island, West Germany.

A typical feature of modern combat is the continuous struggle to achieve fire superiority.

Colonel I. N. Vorob'yev.

commentary

To encourage reflection and debate on articles appearing in the *Review*, the Editor welcomes replies offering timely, cogent comment to be presented in this department from time to time. Although content will tend to affect length and format of responses, they should be kept as brief as possible, ideally within a maximum 500 words. The *Review* reserves the prerogative to edit or reject all submissions and to extend to the author the opportunity to respond.

Comment by
Major General I. B. Holley, Jr., USAFR

IN the March-April 1980 issue of *Air University Review,* Dr. Williamson Murray's article, "British and German Air Doctrine between the Wars," contains a number of assertions that strike me as being founded on somewhat doubtful evidence. One statement in particular interests me intensely. Murray asserts that: "as late as May 1940, the Air Staff would make an effort to shut down the production lines of Spitfires and Hurricanes." (p. 49) This assertion may indeed rest on a sound foundation of fact, but the footnote explanation offers no substantiating source whatever. Would Murray be gracious enough to supply the missing information?

I find it difficult to believe, almost inconceivable, that the Air Ministry seriously entertained any idea of stopping production of Spitfires and Hurricanes at the time indicated. Is it possible that Murray confused evidence of stopping the production lines *temporarily* (to inject some highly desirable modification to improve performance and thus sustain superiority in the air) with stopping production entirely?

The contents of the footnotes (#27) which Murray does offer—"The suspicion exists that Dowding was removed . . . because his success was a direct contradiction to prewar doctrine"—also seems to call for further elaboration. Does Murray have any evidence to offer in support of this "suspicion," or is this nothing more than his own entirely subjective opinion?

Durham, North Carolina

General Holley serves as mobilization assistant to the Commander, Air University; chairman of the advisory committee on history to the Secretary of the Air Force; and professor of history at Duke University.

Comment by
Group Captain Ian Madelin, Royal Air Force

MAY I comment on "British and German Air Doctrine between the Wars" by Dr. Williamson Murray, March-April 1980, referring in particular to the first half of the article dealing with the

British side? Simply put, his case is that the leaders of the Royal Air Force in the interwar years overestimated the potential of strategic bombing. The implication there is quite misleading. It would be truer to say that during the interwar years virtually *everyone* overestimated the potential of strategic bombing. Seen in the historical context of its time, this was a very natural view to take. And, although it is a view which has since been modified by the lessons of World War II, we should not forget that even today there is a respectable body of opinion which still believes it to have been more right than wrong.

But Murray goes on:

> By the end of the 1920s, Trenchard . . . had created a doctrine of air power that excluded *almost every possible role* for the aircraft except strategic bombing. . . . (p. 41. Emphasis added.)

The 1920s saw the inception of the RAF's "air control" operations in Somaliland, Iraq, Waziristan, and Aden, wherein air power became the primary instrument for the military control of these countries—perhaps the epitome of "independent" air action. The RAF won the Schneider Trophy in an aircraft which was the forerunner of the Spitfire. An Army-cooperation squadron was operating in China. The British Legation was evacuated from Kabul in the first air evacuation in history. We could go on, but does this sound like "excluding every possible role"?

Murray also tells us that: "throughout the 1930s the Air Staff showed little interest in air defense. . . ." (p. 46) The Hurricane entered service in 1937 (with eight guns); the Spitfire in 1938. By 1 January 1939, over 20 percent of all RAF squadrons were fighters. The typical RAF fighter of the early 1930s was an all-wooden biplane with an air-cooled engine, open cockpit, and fixed undercarriage; those coming into service in 1939 were all metal with liquid-cooled engines, closed cockpits, retractable undercarriage, and other refinements. Remember, too, that even in those days it could take six to eight years to develop a new military aircraft, so these aircraft had not been created overnight.

Similarly, "the Royal Air Force *absolutely rejected* close air support for the army as one of its missions." (p. 49. Emphasis added.) In fact, on 1 January 1939, 10 percent of all RAF squadrons were dedicated exclusively to what was then called "army cooperation"; not enough perhaps, but sufficient to disprove the claim of "absolute rejection."

Throughout the article, notwithstanding the author's sweeping claims for himself as a historian, there is a complete absence of any feeling for the historical perspective. The interwar years were a period of depression, of disarmament, of defense cuts, and, for the fledgling RAF, a period of vicious interservice (i.e., anti-RAF) rivalries. The real question surely is not what the RAF achieved—or failed to achieve—measured against some arbitrary standard fabricated by the author. It is what the RAF achieved relative to what might reasonably have been expected in the circumstances of the time.

Let us look at a few of these achievements:

—Creation of aircraft experimental establishments.

—Setting up distance records, height records, speed records—pushing the performance frontiers of military aviation.

—Operations in Africa, the Middle East, the Persian Gulf, India, and the Far East—pushing the geographic frontiers of military aviation worldwide.

—Inaugurating air surveys, air evacuation, troop mobility, air control, army cooperation, bomber operations, fighter operations—feeling its way into the roles of military aviation.

—And, not least, establishing the Royal Air Force College (1920) and the Royal Air Force Staff College (1922).

These were not random happenings. There is clear evidence of a pattern here, a pattern for building an air force. Note too that this was not done by merely forming units, which would have produced an edifice without foundation. It was done from the bottom up, by establishing roles, missions, and structure—in a word, by establishing an air doctrine. For in the entirely hostile climate of the period, without a doctrine the inde-

pendent air force would have gone under.

Two points must be reemphasised. First: No one had been this way before; with hindsight we have to admit that these pioneers were remarkably correct in the course they charted. Second: Most of the pressures and influences of the period were working against them; there was every reason for them to have failed. Yet they pursued their idea with a clear sense of purpose; they created an air force, but in so doing they helped lay the foundation for many of today's doctrines of air power. And whatever view we may take of the muddles of the interwar years, I submit that the events of 1939-45 amply bore them out.

As with all innovations that later become a part of everyday life, it is easy to overlook the significance of the starting point and take all subsequent developments for granted. But surely no historian can be excused for doing this, particularly if he takes as his subject British air doctrine between the wars.

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Comment by Stephen H. Morochnick

AS an Air Force Education Services Officer, I found Cecile S. Landrum's article "The Military and the Civilian Economy since the Loss of the GI Bill" (May-June 1980) very interesting.

Articles dealing with civilian educational programs for military personnel give the impression that the writers are peering down a tunnel with very narrow sides. While no one would deny that GI Bill educational benefits and in-service, off-duty educational benefits are important enlistment and retention incentives, I think they would appeal most to the ill-informed.

Nearly any American citizen, in or out of the military service, with demonstrated financial need may qualify for a Basic Education Opportunity Grant (BEOG), which will pay up to $1800 per year to cover college costs. This sum easily matches or even surpasses the amount almost any undergraduate military member on active duty may expect to receive, in a given year, through the Air Force tuition assistance program or even the Vietnam era GI Bill. One might respond that $1800 per year is hardly enough to pay for a year at college and the student would undoubtedly have to work to make up the difference. True, but the service member using tuition assistance has a full-time job and usually works at least 40 hours each week.

Compared to the BEOG, the Congress has been almost shamefully lighthearted in offering the Veterans' Educational Assistance Program (VEAP) as an enlistment incentive to those entering the service in 1977. Examine the program carefully. The member contributes up to $75 per month for 36 months. Thus the member accumulates $2700. The Veterans Administration (VA) matches the $2700 on a two-for-one basis for a total of $5400. Add the $5400 to $2700 and the service member has a total of $8100 to defray the costs of college. But wait! How much did the VA actually give to the member? $5400. And this will be doled out at a rate of $1800 per year. How much may a BEOG recipient receive each year? The same $1800! And the civilian did not have to serve one day in the service to qualify for it.

BEOGs are only the "ground floor" of the financial assistance package available to college students. Other programs available are Supplemental Educational Opportunity Grants, College Work Study, National Direct Student Loans, and

Guaranteed Student Loans. An impressive array of other scholarships, grants, and loan programs is available.

The increasing "burden" of the services' tuition assistance program, which can be measured in the millions, can in no way be compared to the billions expended on the civilian sector by the federal government.

But let us press on to more hopeful signs. Most of the fund sources available to civilians are also available in some measure to military personnel. In most cases the funds may be used to supplement either military tuition assistance or even GI Bill educational benefits.

Programs conducted on military bases are rarely eligible for even partial state funding. The amount of money made available through private contributions and endowments is minuscule. Thus, the total military contribution to this valuable enlistment and retention tool consists of tuition assistance at a rate of 75 percent and the provision of cost-free facilities and utilities. While some may contend that the provision of facilities, utilities, and partial tuition assistance is generous and more than adequate, the fact is that the support is as inadequate as VEAP. In this state, one of the poorest in the nation, one local state college receives nearly $2000 per year for each full-time student. This sum is in addition to tuition and fees charged the student, nearly an additional $1000 per year. No one could seriously argue that Congressional support of on-base, off-duty education comes close to the $2000-$3000 per student income the college receives each year.

The services' educational incentive for enlistment and reenlistment suffers from an extremely serious and significant financial need. In too many cases, the colleges are not able to present the type of high-quality programs they would like because of financial constraints and inadequate base facilities. If colleges conducting educational programs on military bases must continue to depend entirely on tuition aid and cost-free facilities and utilities, they will almost certainly continue to find themselves on the sharp edge of a financial abyss.

The old concept of a GI Bill was that it was intended to assist the service member to readjust to civilian life, to pick up the pieces of his militarily interrupted life, and get on with it. Such a bill is no longer necessary. What is needed is adequate educational funding to help service members adjust themselves to military life and to make them more valuable members of the services.

Therefore, these recommendations ought to be placed under consideration:

- Stop trying to obtain a new GI Bill that will reward anyone for leaving military service.
- Provide colleges with programs on bases with the financial means to establish high-quality, low-cost educational programs through federal funding in addition to tuition assistance.
- Eliminate 75 percent tuition assistance. Replace it with 100 percent tuition assistance.
- Liberalize the educational permanent change of station deferment program to allow military members to remain on station for two or even three years for the purpose of completing educational programs.
- Liberalize the final semester temporary duty, Operation Bootstrap program, so that more career-motivated personnel may take advantage of it.
- Eliminate the two-year service commitment incurred by officers using Air Force tuition assistance.
- Stop feeling apprehensive about the amount of dollars being spent and which should be spent on military off-duty education for service members. At present, 18-year-old civilians can and usually do receive as much educational financial aid as any military member. And if the aid is insufficient to cover all the costs, the student can always get a job wrapping hamburgers for a national chain, which pays a better starting salary than does the Department of Defense.

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In my opinion

THE DO-MORE-WITH-LESS SYNDROME

teetering on the brink

CAPTAIN KENNETH C. STOEHRMANN

IT IS difficult to remember when I first heard the phrase "Do more with less." I am sure it did not make much of an impression on me then. Little did I know that years later it would develop into a major factor in the preservation of our national security and profoundly affect the ability of the Air Force to carry out its mission.

I remember one time the slogan was used. I was an F-111D weapon system officer at Cannon AFB, New Mexico, and it was during an aircrew meeting. The squadron commander was telling us how the 1973 oil embargo had affected us and that flying time was going to be cut back. The flyers did not like that idea, and the commander, sensing our dissatisfaction and lack of understanding of the problem, said, "Guys, we all have to realize that the days of abundant resources and unlimited money are gone. From now on, we as a nation must tighten our belts, trim away the excess fat. And one of the first places to do the belt tightening is in the federal bureaucracy and the Department of Defense in particular. We can no longer have everything we want." And then he said it, "We have to do more with less."

I vividly recall another occasion a few years later, in 1977. I was stationed at RAF Upper Heyford in the United Kingdom, still flying F-111s. It had not been a particularly hard winter in England, but there were spells of cold, bitter weather, the kind that combine rain, wind, and fog into bone-chilling days and even worse nights. In an effort to conserve energy, the base was doing everything it could to reduce heating and lighting expenses. But it was all for naught because, at the end of the year, the money just was not there to pay the bills. Accordingly, the heat was turned off in my squadron over the Christmas holidays. A few days after Christmas, the squadron reopened, and several of us were there at 0700 trying to flight plan the day's mission. The building was cold, and holding a pencil to fill out my line-up card

was difficult. The commander, sensing our obvious annoyance, tried to keep us going, "This is no picnic guys, but we just have to make do. We'll try to get the heat on as soon as we can. I can't make any promises, but I'll see the boss and maybe we can get some relief." And then he said it, "I know this isn't easy to accept, but we have to be prepared to do more and more with less and less."

A third, more recent occasion was during my tour on the Air Staff at the Pentagon. I worked in a directorate that, through several Air Staff reorganizations, had lost almost 50 percent of its authorized slots and was only 90 percent manned in the slots it still had. The workload, according to some of the officers who had been in the directorate for almost four years, had just about tripled. Morale was suffering. The head of the directorate had an officers' call. He touched on several points but invariably came back to the overworked and undermanned theme that was foremost on the minds of his subordinates. The directorate head was a forthright man who "told it like it was." His comments were:

> Everything is getting tougher. We are taking on more work and doing it with less people and resources. But you were all hand-picked for this assignment. I know each of you personally. You are all good men and women. If you weren't, you wouldn't be here. I know you can do the job. But we must all realize something that is now a fact of life. We must do "more with less." I hope you take that as a challenge and try even harder to get the job done.

In each instance, the commander used a different tactic to try and overcome the problem. One was educating me, one sympathized with me, and one challenged me. But, in the end, they all had the same problem to deal with: how to do more with less.

These instances are not, of themselves, important. What is important is that they are part of a larger problem, a syndrome if you will, based on a do-more-with-less philosophy. And this syndrome just might be leading our nation in a direction that is neither healthy, beneficial, nor secure. It seems that "do more with less" has become a panacea for all our problems, a way out of all the troubles of big government, inflation, and social unrest. But the questions must be asked: What if this nation reaches a point where it cannot do more with less? What will happen then?

Those questions must be addressed if we are to continue a strong, secure nation because the do-more-with-less syndrome is a vicious circle that, as presently used, cannot be broken. The syndrome revolves around the idea that a production unit (be it a fighter wing, an Army battalion, the Air Force, or DOD) can produce "more" (which is defined in a variety of ways—better trained troops, greater unit capability, more sorties, etc.) by using "less" (which is also defined in a variety of ways—energy, money, personnel, etc.). Over a given period of time (for example, a fiscal year), the theory is put to the test. Resources are reduced, and production goals are increased. If the unit reaches the new, higher goals and only uses the reduced amount of resources, then for the subsequent time frame, the goals are increased again and the resources are cut still more. The circle is closed. The unit again tries to "do more with less." Thus, the process seems to focus on the idea that if a production unit meets its goals with fewer resources, the possibility exists that the unit can increase production even more by using even fewer resources. And as long as the unit meets the established goals, the "less" becomes even less and the "more" becomes more.

Some measurement is needed to gauge the success of this syndrome. Statistics usually provide the answer because apparently anything that can be quantified will be quantified. We see this manifested on the resources side as personnel used, dollars spent, and energy consumed, to name just a few.

On the production side, it translates into measurement of performance factors: training accomplished, combat readiness of a unit, effective sorties flown, and much more.

These are the rules of the game, and every manager in any production unit faced with having to operate under the do-more-with-less theory knows these rules.

BUT now the problems begin. There comes a point, a point different in every production unit, when the available resources can no longer sustain the increase in productivity. Something must give. It definitely cannot be the productivity itself because the productivity is what is reflected in the statistics, and the statistics are what managers are primarily concerned with under the do-more-with-less rules. And in a military organization, these statistics translate into pressure; pressure that unless you, as a manager, get the job done with what you have, someone else will replace you and do the job more to the boss's liking. Additional resources are not available because the less part of the syndrome dictates continued resource reduction. There are only two alternatives available:

1. Continue high productivity with fewer resources but let the quality of the product suffer.

2. Force greater performance out of the only resource that the manager has some control over, people. (After all, a barrel of oil is a barrel of oil, a dollar is a dollar, but a person has various levels of performance.)

Each is a logical, but potentially deadly, alternative.

These alternatives are available because of two serious flaws in the do-more-with-less syndrome. One is quantification. While productivity levels and resource savings can be measured in absolute terms, the quality of a product is not easily quantifiable. (How "combat ready" is combat ready?) It cannot be listed as a statistic. Likewise, while actual numbers of personnel can be measured, the performance of these people or the conditions under which they work (which influence their attitudes, morale, etc.) are much less easy to determine. The second flaw is, for lack of a better word, manipulation, which occurs as a direct result of quantification. Many of the factors in the productivity and resource areas are known to all, i.e., dollars allocated, gallons of fuel consumed, numbers of personnel assigned. It is hard for either the manager or his boss to dispute these figures. In this instance, manipulation is almost impossible without resorting to an outright breach of integrity and lying. But where the quality of a product or the working conditions and attitudes of personnel are concerned, manipulation is much more possible. This is because the lack of quantification in these two areas allows for a much greater use of subjective judgment. It is the manager's word against someone else's, someone who is armed with no statistical evidence at all, that the product is a quality one. It is the manager's word that he is taking care of the people making the product. Furthermore, in a military organization, this manipulation, if used incorrectly, can be tied to the obedience of the subordinates to the manager using the military chain of command to enforce such obedience.

Both instances are, of course, serious breaches of integrity. But, if a manager makes a conscious decision, because of pressure or other forces acting on him, to sacrifice his integrity, it is easier to do so in the areas of product quality and personnel management (because of the effects of quantification and manipulation) than in any other area that can be supported (or refuted) by "hard" statistical evidence.

It would thus seem that the entire do-more-with-less syndrome hinges on integrity. If a manager's integrity cannot be compromised, then he will readily admit that, at

some point where fewer resources can no longer support increased productivity, the product's quality or the unit's personnel are suffering. In short, the manager will say that the limit of "do more with less" has been reached. He can go no further without making a sacrifice that forebodes trouble for quality or personnel. However, if integrity is compromised, the do-more-with-less syndrome will flourish, and the product quality and personnel will suffer.

But what if the quality of the product or the attitudes of the people who produce it do suffer? Is that necessarily bad? In industry, maybe not. If a product's quality is bad, the product fails. The lawn mower breaks. The roof leaks. The appliance burns out. The car breaks down. All are repairable or replaceable, and only the product's reputation suffers. Likewise, if people are mistreated, they leave the production unit. The unit must then make changes to attract people, or it faces bankruptcy. Even in the extreme latter case, the outcome will probably not affect the future of our nation.

This is not true when the "product" is our national defense and the "personnel" involved are our armed forces. This is a unique situation where the people are part of the product, a very important part. And, even more unsettling, the quality of a part of the "product"—our war-fighting capability—is tested only when we must, indeed, fight a war. That is certainly no time to find that the quality is bad or that personnel cannot perform as expected. Once lost, our freedom will be hard to regain.

Of course, there are those who maintain that the product's quality is good, as evidenced by the lack of war. This argument is faulty for two reasons. One, advocates of this point of view equate the product to deterrence when, in actuality, deterrence is only one part of the product. While deterrence has, to date, been successful, that is not a valid base from which to argue that the other part of the product, our war-fighting capability, should be allowed to deteriorate. For if deterrence does fail and the deterrence part of the product proves to be bad, we must have that war-fighting capability to fall back on. Second, one must seriously question whether deterrence, even if viewed as the total product, is, in effect, working. The already heated arguments over the SALT II Treaty and the Soviets' massive military buildup that erodes our deterrent's survivability must be taken into account. It is not a question of whether deterrence has been successful but whether deterrence *will be successful* in the future. That is where the judgment on the product's quality must be made, and that judgment does not seem to be a favorable one at present.

Thus, the point is made. As it regards our national defense and armed forces, the product must be a quality one; the personnel must be the best. No compromise in quality or personnel can be tolerated. To do so would be disastrous.

BUT has the do-more-with-less syndrome's trade-off point been reached? Has integrity been compromised to make the productivity look good at the expense of quality and personnel? Have we, as a nation, been blind in looking for that point, the point of maximum returns for minimum resources? Are we teetering on the brink of disaster?

Proponents of the do-more-with-less syndrome would say no. They proudly point to lower resource usage and higher productivity to prove their case. But, when asked about the quality of the product or the well-being of the personnel, the proponents can only point to statements by the managers themselves, statements that usually reflect that everything is all right. After all, what manager is going to say his product or his people are in trouble? What manager wants to lose his job? But,

taken one step further, when asked about a possible compromise of integrity in the managerial ranks, the do-more-with-less proponents point to the track record. Have there been any breaches of integrity? Have there been any documented (or demonstrated) acts where integrity was shown to have been lax? Have any of the products proved to be faulty? After all, deterrence has been working ever since its inception after World War II. Have any of the people making the product ever complained? Until now, the answers seem to have been no to most, if not all, of these questions.

Until now. Recent pronouncements seem to indicate a possible change. Maybe cracks are appearing in the previously impenetrable dike that shored up the proponents of the do-more-with-less syndrome's case.

- First, integrity and quality of the product. On 13 March 1979 Air Force Chief of Staff General Lew Allen, Jr., published a letter to all Air Force personnel. In the letter, he discussed a series of allegations made by an entire aircrew training class. Some of the allegations were found to be true, others not. But General Allen found the issue disturbing enough to bring it to everyone's attention. One section of the allegations list stated:

> . . . it was alleged that serious integrity problems were evident:
>
> —Certifying flying training requirements as accomplished when they were not.
>
> —Changing take-off times to put them in the "on time" window when, in fact, they were late.
>
> —Failure to document aircraft discrepancies for fear of reprisal.
>
> —Reporting sorties as effective and productive when they were not.
>
> —*Commanders "accommodating" to a system that constantly calls on them to do more and more with less and less.*[1]

That is a breach of integrity. That is downright lying to "make the numbers look good." That hits home!

- Second, the people. General Allen made the following comments concerning officer retention in an address to Arizona newsmen:

> We have compounded the problem ourselves with sometimes poorly focused management efforts and pressure to compensate for force reductions and to support increased readiness by working longer hours. We've pushed our people hard. To some extent, we may have lost the vital balance between concern about the task and concern about the individual. We are now paying closer attention to this balance—and making improvements. . . .[2]

A problem unique to the Air Force? Not according to General Bernard W. Rogers, former Army Chief of Staff, in an address to business executives in Philadelphia:

> I am concerned about the cost of national defense. Allocating more resources . . . will considerably improve it; failing to apply them can gravely jeopardize it.[3]

- Third, the statistics. These are the symbolic figures that the do-more-with-less proponents point to when bolstering their case. Here are a few statistics not often cited:[4]

Category	1964	1974	1979
DOD budget as percent of total federal budget	42.8	29.1	22.7
Air Force budget as percent of total federal budget	17.2	8.9	6.4
Total Air Force personnel (thousands)	1,179	932	811
Active Air Force aircraft	15,380	12,132	9,037
Air Force major force squadrons	581	421	403
Air Force budget (in constant FY80 dollars) (millions)	53,491	34,726	33,451

By any measure, by any standard, everything listed here shows a definite "less" in resources. There is no area in which increases are observed.

But what about the "more"? How do you show that? Not as easily, but it is possible. Talk to any squadron commander whose unit is only 80 percent manned but handling his full wartime mission. Talk to any maintenance officer or noncommissioned officer whose duty days are getting longer and longer. Talk to any staff officer whose piles of

paperwork and bureaucratic red tape continue to mount. Look at the inspector general's tasking orders, where flying wings must now strain to fly the predetermined number of sorties on a "sortie surge" and also must better previous scores in other areas of evaluation. And finally, ask the do-more-with-less proponents themselves. They, of course, will show you all the information you need to document the "more." But maybe they will not do so in the context of this discussion.

- And the biggest crack of all in the dike is the stark realization that our nation has restored the mandatory registration of 18-year olds and might be forced to reinstate the draft. In this case, the "more"—the combat capability of the Army in particular and the armed forces in general—cannot be obtained with "less"—reduced manpower through voluntary military service. As General Rogers prophetically commented a year ago:

> As a minimum, in my opinion, the Selective Service System must be reenergized and the registration of 18-year-olds commenced again.[5]

IN THE final analysis, what is happening seems to be almost criminal. Not because there are strong advocates of the do-more-with-less syndrome. Doing more with less is not inherently bad, as waste and repetition should be eliminated. Not because integrity is at stake and has been compromised. There are effective ways to correct such problems. Not because personnel are being treated unfairly. That, too, can be corrected, as General Allen has pointed out. It is criminal because what all this leads to is a grand disillusionment of the American people and the senior decision-makers of this nation. As a whole, the military establishment (and, who knows, maybe other governmental agencies) is projecting a capability that possibly does not exist in wartime. We are doing so much more with so much less that the pressure to continue the syndrome's cycle is intolerable. We are making the numbers look good to satisfy the bosses while overrating the true ability of our military. We are compromising our quality and our people. We are tampering with the security of our nation.

The solution? No more accommodation, more truth. Break the cycle if indeed the "more" versus "less" indicates or dictates that the limit has been reached. However, we must not intentionally break the cycle just to escape the do-more-with-less philosophy. That would only further compromise our collective integrity and make us no better off than we are now. If more *can* be done with less, then let's do it. If it cannot be accomplished, then we must first admit that fact to ourselves and then tell our superiors about it. Be honest.

If it should come to another armed conflict and we, as defenders of our nation, cannot perform as expected, we have only ourselves to blame. We cannot fight and win a war with statistics. Adequate national security is based on a demonstrated military capability that costs money and men. We can, and should, trim these areas when possible to realize resource savings while increasing capabilities. But we have trimmed enough and, under present constraints, expanded our capabilities to the limit. To "do any more with any less" now, invites disaster.

U.S. Air Force Academy

Notes

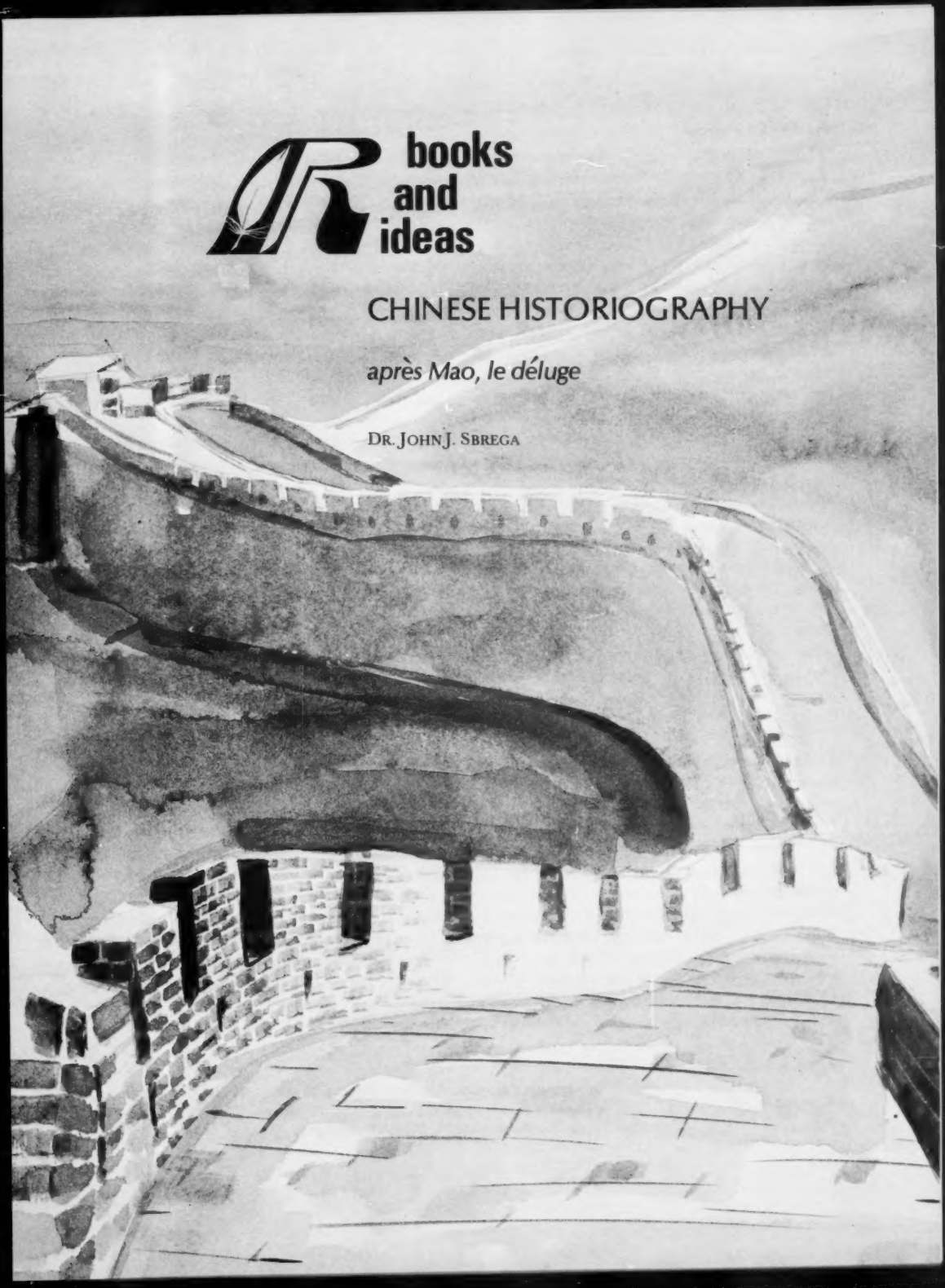
1. Allen to ALMAJCOM-SOA/CC, 13 March 1979, Subject: Integrity. Emphasis added by author.
2. "Chief Faults Air Force," *Air Force*, March 1979, p. 120.
3. Ed Duggan, "Rogers: Our Deterrent Must Be Credible," *Pentagon News*, April 26, 1979, p. 1.
4. Data for this section was taken from U.S. Air Force (AF/ACMC), *Pocket USAF Summary, 1979* (Washington: U.S. Air Force, 1979).
5. Duggan, p. 1.

books and ideas

CHINESE HISTORIOGRAPHY

après Mao, le déluge

DR. JOHN J. SBREGA



THE Western world's fascination with China began long before the voyages of Columbus. The American version of this enchantment took concrete form in 1784, when merchants from Philadelphia and New York underwrote a perilous Pacific journey to Canton for the trading ship *Empress of China.* The enduring myth of the China market continues to the present day. In fact, the sudden announcement of warming relations between Washington and Peking as well as recent events in Indochina have provided a new impetus to an old dream.

This latest phenomenon has been accompanied by a spate of publications about the People's Republic of China or, as it is more popularly known, Red China. The sheer volume of writings on China even seems to be rivaling the fashionable "If it feels good, it's O.K." literature that has dominated commercial bookshelves in recent years.

Three of these books are representative of three traditional categories of American writing about China. First, there is the group that pleads for a better understanding of China and her leaders. How are we to deal with this formidable international power, the authors of these works argue, unless we develop a historical awareness of the Chinese Communist (CHICOM) revolution and Maoist thought? Richard H. Solomon asks—and tries to answer—this question in *A Revolution Is Not a Dinner Party.*

Those in the second category accept the premises of the first but add an extra dimension that can be conveniently summarized in the slogan "I was there." Adopting a personal perspective, these writers, invariably in patronizing tones, assure us that the Chinese Communists were, after all, simply misunderstood nationalists, or agrarian democrats, or "Radish Communists" (red only on the outside), but certainly not part of the "creeping tentacles of the international communist conspiracy" that so alarmed our Cold Warriors. If only FDR (insert any subsequent VIP's name—another characteristic of these books is flagrant namedropping) had listened to me, these authors moan, my personal experience in China would have salvaged American foreign policy. Although less grandly conceived, John McCook Roots uses this point of view in his biography of Chou En-lai, entitled simply *Chou.*

But what are we to do with this accumulated historical knowledge and enlightened understanding? Happily, there is a third category. These brave authors grapple with the question: What is to be done? At worst, these studies dissolve into mere speculation—imagine Jeanne Dixon in academic garb—but, at their best, they can provide a useful guide in marking out new paths for Sino-American relations. In this latter class, A. Doak Barnett has produced a masterful survey in *China Policy.*

RICHARD SOLOMON† seeks to blend familiar American images of China into "interpretive themes which seek to give them meaning in a Chinese context." (p. 2) Professor Solomon, a former staff member for the National Security Council, is an expert on China and the Chinese Communists. He believes that an understanding of our own cultural biases will somehow aid us in appreciating the Chinese perspective.

In fact, Solomon does not produce the book he says he is going to write. Early he promises "to break down American stereotypes of China and contrast them with

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†**Richard H. Solomon, *A Revolution Is Not a Dinner Party: A Feast of Images of the Transformation Maoist China* (New York: Anchor Press/Doubleday, 1976, $9.95), 199 pages.**

Chinese myths and images of China." Then, he adds that "the contrast . . . will lead to an honest appreciation of our differences, if not a clearer grasp of Chinese realities." (p. 31) But the rest of the book is a hodgepodge of unconnected chapters whose only common denominator is a sympathetic tone that is remarkably uncritical of all things Red Chinese. Solomon never expands the unifying theme he alludes to, nor does he develop the objective vantage point from which to analyze Sino-American relations that he promised his readers. Even worse, there is no concluding segment that explains "an honest appreciation of our differences." (p. 31)

Instead, we are subjected to a series of complaints or theories, largely unsubstantiated, springing from the author's very personal viewpoint. For example, the American use of the Boxer Indemnity for a Chinese scholarship program becomes, for Solomon, a "patronizing righteousness." And the author's musings about the vital importance of "Swimming" amounts to little more than an overstrained construction that cannot support the weight attributed to it. Did Mao's famous 1966 dip in the Yangtze really "shock a sense of activism back into the Chinese Communist Party"? (p. 117) Did the event really take place as it has been reported?

Nevertheless, there is value in the book that may be found by stripping away the exaggerations and convoluted theorizing. The chapter "Contradictions," for instance, goes to excess in ascribing noble impulses to a CHICOM leadership that other observers have criticized as wavering and confused. Yet, Solomon has identified a key point of analysis in this chapter by exploring "the major social and political contradictions which have been at the center of conflict and change" in China. (p. 124)

Other chapters, notably "Eating," "Words," and "Emulation," contain nuggets of insight that can be found only after unpiling the theoretical baggage hiding them. What are we to make of a passage extolling the virtues of Mao and urging the people to "vomit the bitter water" of hardship as opposed to the Confucian model of "swallowing their bitterness"? This ambitious passage concludes with Mao's ridiculing the Nationalist Government as "a paper tiger, incapable of eating anyone." (p. 45) A similar strained ambiguity emerges in "Words." The author labors to contrast the Confucian respect for learning with the dual Mao emphasis on activism and castigation of "book worshippers." According to Solomon, the former led to "a measure of deference to those in authority" while the latter fostered a true revolutionary spirit. (p. 55) Once again, the reader can actually gain certain insights by cutting through the heavily laden theorizing. This chapter produces some discerning analysis by Solomon on the rise and fall of the Cultural Revolution.

The chapter "Emulation" is a specific example of the basic analytical flaw of the entire book. Solomon patiently narrates the tortuous path that the CHICOMs have pursued as they accepted or rejected various models to emulate. The Confucian model, of course, had to be rejected. The Leninist experience was accepted, then modified. The party plunged into turmoil with several authority figures presented as models. Mao then purged his opposition or alternative models, except for Lin Piao. Other problems followed that decision. Narrating these ideological gymnastics, Solomon refuses to impose any critical, evaluative judgment. Indeed, here lay the main weakness of the book. The author remains too aloof in an uncritical and sympathetic (if not apologetic) posture. The confusion and blundering that leaps out at the reader in "Emulation" goes unchallenged by Solomon. In his nearest approximation to an editorial comment, Solomon merely points out, in his maddeningly detached style, that the CHICOMs have long sought "a constant and delicate

balance" between the universal truths of Marxism-Leninism" and "the particular circumstances of Chinese society." (p. 87) And, astoundingly, in a chapter concerning CHICOM rejection of all role models (revolutionaries must, after all, be flexible), the author offers no analysis about the pervasive cult of personality surrounding Mao. What happened to all those little red books?

No, there is little balance here. Solomon, in his silence, seems to surrender his scholarly responsibilities. He does not, in truth, concoct an unqualified apology for the CHICOMs; nevertheless, he neither presents critical judgments nor calls attention to CHICOM failures. In fact, a disturbing—if measured—fascination emerges in these pages between Solomon and Maoism. The discerning reader who can manage to keep a skeptical perspective will gain some insights about Red China. But will most readers bother to take the trouble? With his distinguished qualifications, Solomon should try again. He knows his subject and will, undoubtedly, make valuable contributions to our dismal understanding of China. In this particular effort, however, he is not at his best. Despite his presenting a considerable body of knowledge about China, the author has fallen short of a praiseworthy premise. The title of the first chapter, "Mything the Point," might well serve as a capsule summary of the book by a reviewer with a lisp.

SIMILAR problems beset the biography of Chou En-lai by Roots,† an experienced American journalist. Like Solomon, Roots paints an unquestioning and uncritical portrait.

For the most part, the book covers ground already well traveled by scholars. There is little that is new here. Other works, notably Hsu Kai-yu's *Chou En-lai: China's Gray Eminence* and Dick Wilson's *The Long March* (as well as more recent books by Dun Jen Li and Suzanne Pepper), provide more detailed analysis. For example, one of the key decisions in Chou's life, to embrace communism in 1919-20, is quickly glossed over by the author. (pp. 19-21) Furthermore, Roots offers little or nothing about Chou's military role during World War II and the Chinese Civil War.

Perhaps the chief value of the book stems from Roots's firsthand experiences in China and from the forty-year friendship between Chou and the author's family. This personal perspective does lend some interest to an otherwise unexceptional book. Excerpts from the family's correspondence reveal a lengthy list of distinguished visitors to the Roots home. Chou, in fact, stayed with the family at Wu-han—the temporary wartime capital in early 1938—during his efforts to arrange a working agreement with the Kuomintang. Generalissimo Chiang Kai-shek and his wife were also close family friends. In one little-known episode, Roots suggests (although he confesses having no corroborative evidence) that his father, Bishop Roots, had saved Chou's life in 1927 by providing refuge at the British Concession in Hankow during a Kuomintang purge.

The author has some impressive credentials, and his "China Connection" undoubtedly goes far in explaining why his book was published. Born in China, Roots was among the earliest American correspondents to return to China. He says that an interview with Premier Chou shortly before his death represents "a key element in the preparation of this book." (p. vii) At Harvard and elsewhere, Roots has had the benefits of contact with distinguished scholars. The acknowledgments section lists impressive

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†John McCook Roots, *Chou* (New York: Doubleday, 1978, $8.95), 220 pages.

associates: Arthur M. Schlesinger, Sr., John K. Fairbank, James C. Thomson, Jr., Edwin Reischauer, Lucien Pye, O. Edmund Clubb, and A. Doak Barnett. Edgar Snow and his family are also numbered among Roots's acquaintances.

Almost predictably, the biographer has become enamored with his subject. From Roots's perspective, Chou takes on an aura of infallibility. The author stresses that Chou held top party posts longer than any other Communist, "not excepting Mao, Lenin or Stalin." (p. xvi) It is Chou who provided the "moving spirit" (p. 65) in the 1935 elevation of Mao as Party Chairman. It is Chou who produced in 1922-24 "attempts at mediation that can only be described as heroic" (p. 24) in trying to bring together competing factions among Chinese youths in Europe. But there is scant analysis or critical judgment. Mao's own considerable abilities are minimized. And Chou largely failed to arbitrate the ideological divisions of those Chinese youths. In fact, what success he did have—namely, with the Communists—may well account in some measure for his growing commitment to that movement. We do not know, and Roots does not give us much help. Instead, we are told that Chou was "a resourceful peacemaker" who "always held his liquor well." (p. 25) We even learn that often Chou, as a young student, could "complete a composition assignment in half the required time." (p. 16) The reader even might anticipate claims from Roots that Chou leaped tall buildings in a single bound.

The book does provide a light, popularized version of Chou's life, and it is easy to read. There are a few insights, especially a chilling description of Roots's experience with CHICOM anti-Western propaganda when he attended the play *Roar China.* Moreover, Chou's unique personality does occasionally break through in passages such as accounts of the Long March and of the dark days for the CHICOMs early in the Civil War. But the value of this particular example of the "I was there" school of history is, unfortunately, limited.

ONE of the top China experts in the United States is A. Doak Barnett. His lively scholarship has produced an impressive number of books and articles about China for over twenty years. He is currently associated with the Brookings Institution.

His book *China Policy* outlines the contours of American perceptions and policies regarding Communist China.† Immediately after 1949, deep mutual antagonism poisoned Sino-American relations. During the 1960s, important changes in this hostile deadlock occurred, such as the growing Sino-Soviet estrangement and a more flexible attitude in the war-weary United States about China. Barnett feels that the opening of relations between the two countries in 1972 represents a historical watershed. Although President Richard M. Nixon and Henry Kissinger are widely credited with arranging this diplomatic breakthrough, Barnett applauds "bold initiative by both sides." (p. 2)

Thus far, the gains for both countries have far outweighed the political costs. Yet Barnett warns that developing closer relations will entail more meaningful compromises—compromises that require difficult political decisions. The limits of Sino-American détente must be recognized, and, consequently, a pervasive friendship is unlikely in the near future. According to Barnett, huge obstacles exist to thwart truly close cooperation between Washington and Peking. These obstacles include "the ideological gap, conflict of political values, and divergence of many

†A. Doak Barnett, *China Policy* (Washington, D.C.: Brookings Institution, 1977, $8.95), 131 pages.

broad foreign policy goals, as well as basic cultural, social, and economic differences." (p. 19) In fact, Barnett argues that Japan and the Soviet Union may well be more important to American interests than China. He feels that "the most important single objective of U.S. policy" (p. 78) in the Far East is the maintaining of an effective friendship with Japan. And if American global security interests dictate that first priority be given to preventing a military conflict with the Soviet Union, then American policy in the Far East must not upset the fragile strategic balance between the two great superpowers.

It is vital that all four Far Eastern powers (Is Vietnam becoming a fifth?) maintain a strategic equilibrium. None should try to exclude the others. At present, that Far Eastern equilibrium depends on close American ties with a nonnuclear Japan as well as the absence either of Sino-Soviet conflict or of a Sino-Soviet rapprochement. In a brilliant chapter entitled "Relations with Other Powers," Barnett assesses the conflicting and converging crosscurrents of Far Eastern diplomacy. Although his book predates the Asian crisis triggered by Vietnam's invasion of Cambodia and the subsequent Chinese incursion into Vietnam, it is interesting to note how the flexibility of Barnett's analysis can incorporate this turn of events. His views are vindicated rather than made obsolete by the current crisis.

The final chapter, "An Approach for the Future," traces possible patterns of development in Sino-American relations over the next two or three decades. The author wisely avoids attempts at prodigious prognostication. Instead, he carefully constructs an analytical framework for the future that is cautiously optimistic.

Perhaps the major weakness of the book is its narrow scope. Although he deliberately limited his range, the author, nonetheless, focuses too intently on Sino-American relations (this is, after all, what he said he would do) and the four Asian powers: the United States, Japan, China, and the Soviet Union. But, as recently demonstrated, any analysis of Far Eastern affairs must incorporate Vietnam. Barnett has mentioned—and would not deny—that small countries can precipitate international crises by dragging in the big powers. But Barnett seems to lump Vietnam with those lesser countries. Surely, Vietnam must rank as a major regional power. And to the extent that Vietnam does influence Asian affairs, it is vital to involve that country in efforts to promote a stable equilibrium.

THE quality of Barnett's book contrasts sharply with that of the Solomon and Roots works. Each of the other two has a certain popular appeal, and each advances to some degree the growing accumulation of knowledge about China. The reader who keeps a healthy skepticism will find some use—and even some enjoyment—in the books by Solomon and Roots. Barnett, on the other hand, has provided an insightful analysis that should stimulate the reader to further thought. Each of us, in fact, would do well to reflect on the course of Sino-American relations. Too much is at stake for Americans to do otherwise. Brooks Adams, at the turn of the Twentieth Century, frequently pointed out that the locus of power, the leadership of world civilization, had moved westward throughout the history of man from Asia and the Middle East through Europe. Adams confidently predicted that the United States would fall heir to that leadership. He proved to be correct. But at the latter stage of the century, it is worth considering whether that progression is continuing across the Pacific.

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THE IRRATIONAL ASTRONOMERS

CAPTAIN JAMES S. O'ROURKE

WHEN I was a college freshman, I desperately wanted someone to explain the mysteries of the universe to me. What I wanted was a small, understandable book complete with color photos, which would lend some perspective to the bewildering collection of theories and hypotheses offered in my astrophysics text. Instead, it was one set of formulas after another. The parts were understandable, but the whole was not. Somehow, in the melee of conjecture about nebulae, quasars, eclipsing binaries, and intergalactic dust, astronomy in the 1960s had not yet developed a comprehensive or definitive theory about the question that troubles us most: How did it all begin?

IN *God and the Astronomers*† Robert Jastrow does what I wish physicists had done years ago—he speaks to us in English. His remarkable little book details the substance of several theories of cosmic origin, including the now widely accepted "Big Bang" theory. Using the theoretical writings of Ralph Alpher and Robert Herman, as well as the empirical measurements of Arno Penzias and Robert Wilson, Jastrow explains how twentieth-century astronomers slowly came to realize that the elements in our enormous universe are expanding, many of them at speeds up to one hundred million miles an hour.

The odd thing about Jastrow's book is that the material on which his explanations are based has been available for quite some time. Many in the scientific community, however, were unwilling to accept as fact those findings that have been known for much of this century. The scientific theory of Genesis began in 1913 when Vesto Slipher, looking for something else, discovered that "about a dozen galaxies in our vicinity were moving away from the earth at very high speeds, ranging up to two million miles per hour." Slipher's discovery, according to Jastrow, was the first hint that the universe was expanding. Young Albert Einstein, seeking to explain phenomena of a different sort, published his equations of general relativity four years later in 1917. But it was William de Sitter, a Dutch astronomer, who found a solution that predicted an exploding universe, in which galaxies move rapidly away from one another. This, of course, is just what Slipher had observed.

Other astronomers, including Edwin P. Hubble and Arthur Eddington, picked up de Sitter's work and began to accumulate more precise measurements with more accurate equipment. The majority of the members of the scientific community, however, steadfastly refused to accept the logical conclusions drawn from de Sitter, Hubble, and Eddington. Why? Because they seemed to have profound theological implications; and by the mid-twentieth century, science was not yet ready to acknowledge the presence of a supreme being. Jastrow also thinks part of the answer lies in the fact that "scientists cannot bear the thought of a natural phenomenon which cannot be explained, even with unlimited time and money."

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†Robert Jastrow, *God and the Astronomers* (New York: W. W. Norton and Company, 1978, $7.95), 136 pages.

SCIENCE, according to British astronomer Paul Davies, brings several important contributions to the subject of cosmology.† It brings, first of all, concrete information about the world from careful experiment and observation. Second, it injects precision into what might otherwise be a rather vague collection of ideas. Third, and perhaps most important, science furnishes the theoretical foundation for the study and understanding of the observations that have been made. Science seems to have its limitations, however, in dealing with questions of a metaphysical nature.

While Davies and Italian astronomer Paolo Maffei†† have no apparent trouble accepting the idea of an expanding and, hence, a dying universe, many cosmologists have been slow to join them. "This circumstance [of an expanding universe] irritates me," said Albert Einstein. In a letter about the expansion theory, he wrote: "To admit such possibilities seems senseless." Astronomer Robert Herman, in discussing his early theoretical work on the expanding universe, said recently, "There was no doubt that we had a very interesting result, but the reaction of the astronomical community ranged from skeptical to hostile."

Robert Jastrow notes that theologians generally are delighted with proof that the universe had a beginning, but astronomers have been curiously upset. "Their reactions," he writes, "provide an interesting demonstration of the response of the scientific mind—supposedly a very objective mind—when evidence uncovered by science itself leads to a conflict with the articles of faith in our profession." It turns out, he observes, that the scientist behaves the way the rest of us do when our beliefs are in conflict with the evidence. We become irritated, we pretend the conflict does not exist, or we paper it over with meaningless phrases.

Philosophy Professor Ronald Munson of the University of Missouri lectures widely on the topic of "Science Fictions," in which he expresses a frustration with scientists similar to Jastrow's. "We accept science as reliable, objective, and reality-revealing," he says, "but what is the source of our confidence? Until recently, the standard view was that it comes from the method of testing hypotheses against observations. However, actual cases show that hypotheses are not always accepted when confirmed by substantial evidence. Furthermore," he writes, "observation reports and 'facts' seem to be tied to theories."

The work of British astronomers Hermann Bondi, Thomas Gold, and Fred Hoyle seems to be a case in point. For a number of years, they have argued in favor of a steady-state theory: a view which holds that continuous creation is taking place, replenishing the dispersing matter throughout the universe at a steady rate. Mounting evidence to the contrary has not convinced them and their adherents that the universe is not, in fact, in a steady state, but in an inexorable state of expansion and decline. Recent radio-source counts, the discovery of quasars, and the background heat-radiation discoveries of Penzias and Wilson point conclusively in the direction of an enormous primeval explosion.

Both Jastrow and Davies seem willing to accept such a theory and prod us to revise our beliefs in the face of irrefutable evidence to the contrary. The model of an expanding universe derived by Alexander Friedmann

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†Paul Davies, *The Runaway Universe* (New York: Harper and Row, 1978, $11.95), 205 pages.

††Paolo Maffei, *Beyond the Moon* (Cambridge, Massachusetts: MIT Press, 1978, $10.00), 377 pages.

led to the publication of Hubble's law on expansion. Concurrently, there has been a great deal of discussion about the fact that the second law of thermodynamics, applied to the cosmos, indicates the universe is running down like a clock. And if it is running down, says Jastrow, there must have been a time when it was fully wound up.

When asked in 1921 if he believed in God, Einstein replied, "I believe in Spinoza's God, who reveals himself in the orderly harmony of what exists." Einstein and others within the scientific community resisted de Sitter's theory for many years, but Hubble's observations on the speeds and distances of the galaxies finally convinced him that the theory was correct. And shortly before his death, according to Jastrow, Einstein told a visitor that he fully accepted the idea of "a beginning." Others, however, continue to resist.

The reason for such reluctance seems to be a dependence on what Professor Munson calls the "scientific paradigm." And the problem with the paradigm view is that it makes science an "irrational, subjective enterprise." Scientists and laymen alike seem irrationally tied to theoretical beliefs when their conceptual underpinnings have long since been swept away by newer, more precise observations. Such is the case with the expanding universe.

DAVIES, in *The Runaway Universe,* says, "The language which is used to convey these ideas already assumes familiar, fundamental concepts of space and time, and it tends to have a strong philosophical or even religious connotation. Perhaps," he says, "it is expecting too much of science to provide clear answers to them." Jastrow thinks not. Science, he says, in *God and the Astronomers,* if viewed with the cool rationality and open-mindedness of the philosopher, can bridge the gap between astrophysics and metaphysics. But a blind faith in the tenets of science, he says, renders us incapable of escaping the confines of our own narrow perspectives.

Department of English
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Potpourri

The Role of the Joint Chiefs of Staff in National Policy by John Charles Daly. Washington: American Enterprise Institute, 1978, 42 pages, $2.00.

The duties and limitations of the Joint Chiefs of Staff (JCS) have undergone dramatic change since their inception in the early days of World War II, having served eight Presidents in countless and diverse ways. The book is an edited transcript of a Public Policy forum, conducted by the American Enterprise Institute, with John Charles Daly as panel moderator of a discussion group consisting of General George S. Brown, Senator John C. Culver, Dr. Curtis W. Tarr, and General Maxwell D. Taylor. Discussion about the transformed role of the JCS is interesting reading for those having a narrow interest in the operation of the JCS or the Joint Staff, however small their numbers may be.

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Patton's Third Army at War by George Forty. New York: Charles Scribner's Sons, 1978, 192 pages, $14.95.

This book is neither a history of the Third Army nor a biography of Patton. It ". . . is in no way a detailed history . . . but rather a pictorial evocation of 'Georgie's Boys' at war."

Certainly, the photographs are eye-catching and excellent, and they appear on almost every page. The text

is concerned primarily with exploits of the soldiers themselves, actions described being usually at the company level. The reader follows Patton's tanks into the thick of the fighting, the small unit engagements being loosely held together by brief descriptions of the army's progress across Europe.

There are some interesting figures: "Lieutenant Colonel Creighton W. Abrams, then commander of the 37th Tank Battalion, clinched [sic] a cold cigar in the corner of his mouth and said, 'We're going in to those people now.' With that, he swept his arm forward and the charge was on"—into Bastogne. (Abrams later became Army Chief of Staff.)

A particularly interesting chapter is a description of Patton's character in the words of his daughter.

Forty's book competently details the life of the ground soldier in battle. It reads easily and quickly, is full of anecdotes and quotations, and makes enjoyable, if nonscholarly, reading. *Patton's Third* is worthwhile for those who desire a better understanding of the Army in action.

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The Wizard War: British Scientific Intelligence, 1939-1945 by R. V. Jones. New York: Coward, McCann and Geoghegan, Inc., 1978, 556 pages, $12.95.

Basically a memoir, *The Wizard War* fills many gaps in the story of electronic warfare in the European theater of World War II. R. V. Jones devotes the book to his experience as Assistant Director of Intelligence (Science) to the British Air Staff. His mission was to ascertain the enemy's development of new weapons, subsequently to propose countermeasures, and to mask the progress of Allied research and development. He was primarily concerned with advances in aviation radar, electronic navigation, and electronic countermeasures.

Getting an early start during the "Phoney War," Jones was ready for the "Battle of the Beams"—the electronic side of the Battle of Britain. His success in countering the relatively accurate German bombing systems set the tone for his later efforts. During the Allied air offensive, Jones directed his attention to the neutralization of German ground and airborne radar and counterintelligence on Allied navigation systems.

The chapters of the book read like a catalogue of World War II electronic systems: Oboe, Lichtenstein, Window, V-1, V-2, and so forth. In addition, Jones characterizes Winston Churchill, Charles Portal, and scores of others. He provides an insider's view of the conflict between Henry Tizard and F. A. Lindemann and his own findings on Churchill and the bombing of Coventry. Interesting sidelights can be found throughout, such as the use, by both sides, of simple and revealing code names. And, of course, Ultra is revealed as a major source of intelligence for all of Jones's work, underlining the importance to Allied victory of breaking the German Enigma codes.

The value of *The Wizard War* extends far beyond the information on scientific intelligence and electronic warfare. From the first it is evident that the problems and methods of solution are not unique to World War II. The weapons and codes may have improved, but the challenges and methodology are essentially the same. An example is the emphasis Jones places on the error of analyzing evidence solely against our own level of scientific knowledge: ". . . if we can't, they must not be able to either." The Sputnik surprise may be used as a dramatic contradiction. The case is also made for doctrine being far more important than technology alone, a relationship that must be kept in mind with today's increasingly technological means of warfare.

Wizard War is an extremely readable account of British scientific intelligence. The mixture of anecdotes, thumbnail character sketches, and narration reminds one of listening to an old soldier reminisce. The book does have its weaknesses, however; many technical terms are thrown about without definition, and systems are mentioned with a presumption of familiarity. Furthermore, there is no shortage of self-praise for Jones. In spite of this, it is clearly evident that R. V. Jones is a remarkably brilliant and capable man whose accomplishments and credits during the war will easily stand on their own. Profusely illustrated with diagrams and photographs, *Wizard War* provides an interesting and important view of the role of science and intelligence in modern warfare.

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Stable Peace by Kenneth E. Boulding. Austin & London: University of Texas Press, 1978, 143 pages, $9.95 cloth, $3.95 paper.

The author, erstwhile world peace professor at the University of Texas, applies system thinking to the problem of achieving a lasting world peace. He regards war and peace as a system possessing strength but subject to strains. Whenever those strains become too severe, breaks or wars occur. In his view, the objective of policymakers must be to "introduce a bias into the

system that moves it toward stable peace at a more rapid rate." Policymakers need to cooperate with, but distort the overall dynamics of their society somewhat as farmers cooperate with, yet distort, the ecosystem of which they are a part.

Applying systems thinking to the problems of war and peace seems like another step in the ever-increasing dehumanization of life. However, since all other approaches have failed in the past, the idea is one worth exploring.

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Ultra Goes to War by Ronald Lewin. New York: McGraw-Hill, 1978, 398 pages, $12.95.

For the most part, historians write more and more about the same things. The same old stories are told, the same old controversies are aired, and essentially the same old conclusions are reached. This is certainly true of the history of World War II, despite the rising interest in that war, the many historians studying it, and large book sales.

That is, until 1972, when J. C. Masterman added a new dimension to the story with the publication of *The Double Cross System*. He told how the British captured every German agent into England and turned most of them around to deceive their erstwhile employers. Even more startling were the revelations in F. W. Winterbotham's *The Ultra Secret* (1974). Here was exciting new wisdom for students of World War II. It has had the impact of a large weapon right on target, something akin to the discovery of a trunk—no, a truck—full of letters from Washington, Jefferson, or Lincoln. In brief, Winterbotham told how the Western allies were able to read German operational codes throughout most of the war. This means that the Allies, in addition to having an overwhelming quantitative advantage over the Germans, had a significant advantage in intelligence. Accordingly, the history of that war must be rewritten and all assessments and criticism reevaluated.

Ronald Lewin's *Ultra Goes to War* is a step in that direction. The author is a much-published military biographer with books on Churchill, Montgomery, Rommel, and Slim. Here he traces the development of the German Enigma machine and how the Poles were able to obtain it. Although Lewin is a bit vague on this point, nevertheless, it is clear that this feat may have been the most important Polish contribution to Allied victory. Lewin goes on to describe the role Ultra played in the war. He shows that the device was responsible not only for Allied victories but also for such disasters as the scattering of PQ-17 and could not prevent such setbacks as the loss of Crete, the German Channel dash, the Battle of Kasserine Pass, and the Battle of the Bulge.

Relative to the ground and sea war, little attention is given to the use of Ultra in the air war. It may be that Ultra had little impact there, but that is precisely what must be researched and stated. In view of the criticisms of Allied targeting, damage assessment, and claims of German aircraft destroyed, the contribution of Ultra is important for a fair and complete appreciation of the air war, and how well the airmen did their job.

So this book scratches the surface and whets the appetite on a very important aspect of World War II. Because Lewin has a good feel for how Ultra fitted into the entire war and has conducted a number of interviews, his effort gives a good overview. Much to his and the publisher's credit, both endnotes and a bibliography are included. But now that we have such an overview, we are ready for an in-depth study of this important subject.

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The Camp David Framework for Peace: A Shift Toward Shared Rule by Daniel J. Elazar. Washington: American Enterprise Institute Studies in Foreign Policy, 1979, No. 236, 20 pages, $1.75.

The West Bank and Gaza: Toward the Making of a Palestinian State by Emile Nakhleh. Washington: American Enterprise Institute Studies in Foreign Policy, 1979, No. 232, 65 pages, $3.25.

Now that the Egyptian-Israel peace treaty has been signed, the real business of implementing its ambiguous provisos begins in earnest. The most pressing issue will certainly be the question of Palestinian autonomy in the Israeli-occupied West Bank and Gaza Strip, and it is to this question that Daniel J. Elazar and Emile A. Nakhleh turn their attention in two recently published American Enterprise Institute Studies in Foreign Policy.

Professor Elazar's point simply stated is this: the federative option linking two or more entities should be revived—here Israel, Jordan, and a Palestinian autonomous region—"through a combination of self-rule and shared rule in a contractually protected way so as to preserve their respective integrities." (p. 9) Essentially Elazar is proposing that Jordan, as the Arab state in Palestine, and Israel, as the Jewish state in Palestine, form a condominium over the occupied territories in

which only local affairs are left to the administration of the Arab and Jewish residents of the territories. (p. 9) In point of fact, the author is merely providing a rationalization for the implementation of Menachem Begin's 26-point autonomy scheme.

This scheme denies ultimate sovereignty over the occupied territories to the Arabs and for that reason, needless to say, it has been very unpopular among them. If Elazar were to attempt to justify the federative option within the Begin plan on the grounds of realpolitik and Israel's security interests, he might gain a more respectful hearing. As is, he chooses to develop his argument around a number of dubious sociohistorical assumptions: first, today's Palestinians constitute an "instant" people, a "public" whose primordial ethnoreligious identity has not been eliminated by modernization; (p. 2) second, the ancient character of the Palestinians is constant, not the boundaries within which they live; (p. 3) third, all regional polities are compound ones with no possibility of becoming ethnically unitary nation-states without resorting to genocide; (p. 3) and, finally, only where a dominant empire has existed have peaceful relations between peoples obtained. (p. 3)

Here Professor Elazar is asserting some of the tired old saws of the Orientalist: that peoplehood does not exist without modernization and that the political expression of that modernization must rest solely on the concept of the Western nation-state; that peoplehood is inconceivable without a concept of historically determined, fixed territoriality, a territoriality which cannot be achieved without the mass elimination of minorities within the delicately balanced ethnic "mosaic" of the region; and that balance is impossible if some dominant state does not at all times prevail.

Thus, in the guise of a federative option under the Begin scheme, the author is proposing a *Pax Israelitica* over the Palestinians and their reduction to a semiautonomous, self-governing entity (*millet*) controlled by the dominant Israeli state.

Professor Nakhleh, in his study, argues the question from a different perspective. He points out that institutions already exist in the occupied territories which could provide essential socioeconomic services in any posttreaty transitional regime providing that the cooperation of the local Palestinian leadership is secured. This cooperation, Nakhleh claims, can only be obtained under two fundamental conditions: the termination of Israeli occupation and a recognition by all concerned of the Palestinian right to self-determination.

If Professor Elazar's argument suffers from that kind of myopic ethnocentrism that can only superimpose a Western political model on an Eastern set of circumstances, Professor Nakhleh's argument suffers from a too easy ingenuousness that equates the moderate position of the West Bank and Gaza elites with the position of the Palestine Liberation Organization (PLO), which they claim to represent their views politically. Although the consensus of the present American administration is that the PLO can be deradicalized, the final proof of this assertion is still wanting. A radical PLO leadership in a transitional regime could certainly upset Professor Nakhleh's dream of moderation. So it is not enough to explain this uncomfortable possibility away by saying that the West Bank and Gaza elites cling to the PLO hardline as a tactical maneuver in direct proportion to the extent that the United States and Israel refuse to deal with Arafat. (p. 65)

At any rate, both of these studies are worth the serious student's scrutiny if only for their value as an indication of the directions divergent points of view may sometimes take.

Dr. Lewis Ware
Air University Library
Maxwell AFB, Alabama

Nuclear Power: Vol. III, Energy, Power, and Environment by James J. Duderstadt. New York: Marcel Dekker, 1979, 388 pages, $27.50.

The Gordian knot of the energy crisis presents a potentially mortal threat to the economies of the United States, the industrialized nations, and the Third World as well. Thus, it is the very essence of a national defense issue. How can we make sense out of conflicting assertions of radiation's dangers, technology's promise, the economy's needs, proliferation's risks, the ecologist's fears, and the politician's truths? To bring order to the energy chaos in our own minds, we certainly cannot look to the typical advocacy publications, which quickly appear at the forefront of each new policy issue to point with dismay at the hazards of each of the candidate courses of action. The complexity and immediacy of the energy problem require a different approach if we are to unravel the energy problem in time.

Duderstadt's *Nuclear Power* traces the nuclear strand through the energy Gordian knot with impressive skill, patience, and objectivity. *Nuclear Power* responds to the complexity of the challenge through the disciplined methodology of the textbook. While the author carefully explains unfamiliar concepts as he exposes the technology of nuclear power generation, he is not writing for the uninitiated. *Nuclear Power* is carefully tailored to a particular level of scientific understanding, estimated by the author to be that of an engineer-

ing undergraduate at a major university. Fortunately for the military professional, this level of competence equates very well to the technical awareness of the military officer who is some years away from hands-on academic experience in the sciences.

Duderstadt unfolds his discussion of nuclear power with order and clarity. He presents the energy problem; briefs the history of nuclear power; reviews the theory of nuclear energy release; describes the different types of reactors, the way they generate usable electricity, and the nature and effects of the radiation produced in the process. His description of alternative nuclear fuel cycles and the possibilities for controlled thermonuclear fusion are particularly enlightening. He concludes with a strong and objective comparison of the available energy alternatives. His message, written before Three Mile Island, is one of balance between the potential costs and risks of the several energy sources that must be developed together to contribute to a satisfactory energy solution.

As much as *Nuclear Power* contributes to the solution of the energy problem, the volume does not contribute to the solution of the equally vexing problem of inflation and thus it may be most economically procured through a well-stocked library.

Lieutenant Colonel John J. Kohout III, USAF
DCS/Operations, Plans, and Readiness

Alexander the Great and the Logistics of the Macedonian Army by Donald W. Engels. Berkeley: University of California Press, 1978, 194 pages, $16.50.

The career of Alexander the Great is shrouded in myth and romanticism, though certain details of his life are known even to schoolchildren. Most studies have concentrated on his personal life, however, and have ignored the military strategy he followed in winning an empire of staggering dimensions. Donald W. Engels's book *Alexander the Great and the Logistics of the Macedonian Army,* is a long-overdue examination of the basis of Alexander's military triumphs. Recognizing the truism that "an army marches on its belly," Engels makes the argument that Alexander's superior logistics organization was the key to his success. Other authors have recognized this point; but none have made so detailed analysis to support it. Examining the nutritional requirements of men and animals, and the relationships of time and distance, Engels attempts to prove what was and was not possible for Alexander to achieve.

One of the strengths of Engels's book is his critical examination of the source material available on Alexander, an examination that disproves some of the present interpretations of his career. An example is Engels's treatment of Alexander's march through the Gedrosian Desert, during which he lost between half and three-quarters of his men. Even such a recent book as Robin Lane Fox's *Alexander the Great* states that Alexander's route followed the coastline of the Arabian Sea. Engels demonstrates that the route Fox sets forth was under water when Alexander crossed the desert, since the coastline has advanced some 20 to 30 miles during the past few thousand years. Engels further states that the only possible route Alexander could have followed was farther inland because of his supply requirements. Engels has examined every aspect of the supply requirements Alexander's forces faced, in order to determine how his army supplied itself and to determine how these considerations directed his tactical and strategic movements.

This is a superb book, using detailed historical research and sound, thorough analysis to write an outstanding history of Alexander's generalship and logistical genius. The maps at the end provide a fairly detailed route of his travels and correspond nicely to the organization of the book.

Captain Daniel T. Kuehl, USAF
Grand Forks AFB, North Dakota

Flying the Weather Map by Richard L. Collins. New York: Delacorte Press, 1979, 244 pages, $12.50.

Flying the Weather Map combines a healthy respect for the consequences of weather ignorance with a meteorological layman's analysis of weather cause and effect. Though the analyses are basically sound and a study of the first five chapters might improve the novice pilot's understanding of weather phenomena, the author fails in his attempt to simplify a complex subject. Later chapters, flight histories, will interest pilots of small aircraft but will add little to their ability to cope with unexpected or unpredicted weather development.

The author, Richard L. Collins, is obviously a qualified pilot and knowledgeable flyer. He has learned from experience to expect the unexpected and to apply some valuable rules-of-thumb in coping with weather. His book may interest flyers who have no knowledge of weather parameters, but it will have little appeal for either the professional flyer or the professional weather analyst.

Lieutenant Colonel Billie D. Capshaw, USAF
Air Command and Staff College
Maxwell AFB, Alabama

Air War—Vietnam by Drew Middleton, editor. New York: Bobbs-Merrill Company, 1978, 361 pages, $15.00.

Air War—Vietnam is an outstanding compilation of war stories about the Southeast Asia conflict. However, it should be noted that each of the four parts of the book was originally published as an individual monograph in the USAF Southeast Asia Monograph series. This reprint in no way detracts from the original vitality, enthusiasm, or interest of the pieces, but the reader should be aware of the slightly erroneous insinuation made by Drew Middleton in his fine introduction to the book. That is, this book is *not* the Air Force telling its story, if he means the "official" Air Force story. Although the monographs were originally published by the Air Force as "unofficial" documentation of the Southeast Asia conflict, all introductions, forewords, credits, clarifications, and caveats have been removed, leaving the reader a little "naked" as to the real genesis of the book.

The original intent of the monograph series was to record the real, personal, in-depth involvement of the people behind the air power that was employed in our nation's longest armed conflict. Except for Part IV, "The Mayaguez Incident," which is monograph 5 in the series (entitled "Fourteen Hours at Koh Tang"), the book was written by combat veterans, who were attending either the Air War College or Air Command and Staff College. Parts I, II, and III (Monographs 1, 3, and 2, respectively) were written in partial fulfillment of requirements for graduation and edited by various other officers at Air University, the Air Force Academy, and the Air Staff. Part IV was written by a Pacific Air Forces staff officer at the specific request of General Louis L. Wilson, Jr., then CINCPACAF, to document those three hectic days primarily of helicopter operation over, on, and around Koh Tang Island. This document also has had its acknowledgment, foreword, preface, and appendix excised, which in my opinion was a mistake.

Now that the air is clear to comment on the book itself, I will not dwell on this because once we understand the intent of these writings, the content becomes more predictable. As Middleton indicated in his introduction, here we find recorded, much that is documented for the first time, the individual deeds of real live people—front line people—those people who were responsible for getting the job done. The tactics they used, the frustrations they faced, and the personal attributes that make or break a mission are all there. The acts of true bravery and courage recorded here outweigh the acts of incompetence and ignorance, but that is to be expected in a book written by men who were there and had to get the job done. (The tree-busting missions do not make lasting memories nor do they make interesting reading.) The book is one of the best compilations of aircrew actions, written by the men who lived them, and if the reader accepts it as such, he will learn much that has not been told before and enjoy the book immensely.

Lieutenant Colonel Donald L. Hutchinson, USAF
Cannon AFB, New Mexico

Munich: The Price of Peace by Telford Taylor. Garden City, New York: Doubleday, 1979, 1084 pages, $17.50.

At Munich in 1938, British and French leaders sacrificed Czechoslovakia to Hitler as the presumed price of peace. General Taylor's brilliant analysis of the negotiations is *the* definitive study of European politics of the era. Hitler was neither a planning genius nor an opportunistic demagogue, but he did prove more correct than German military leaders who opposed him, firm in their beliefs that Britain and France would come to the aid of the Czechs. The abject subordination of France to British leadership conceded all important decisions to the myopic, arrogant Prime Minister Chamberlain, whose ignorance of foreign affairs was equaled only by his total self-assurance. Czechoslovakia, unable and not allowed to speak for herself at the conference table, was handed over to the dictator.

Of special interest to the military reader is the role of American folk hero Charles A. Lindbergh, whose naïve and wildly overoptimistic estimates of the capability of the German *Luftwaffe* against London and Paris completely undermined the confidence of the Western leaders. The *Luftwaffe* had no plans nor even a bomber organization to conduct a strategic air offensive; the Germans used their Air Force almost wholly in direct support of the battlefield. Those attacks eventually made against London came in retaliation, after repeated warning to the British to cease attacks on Berlin. General Taylor calls the bloodless triumph at the conference table "the only victory of strategic proportions the *Luftwaffe* ever won."

Tragically, the Treaty at Munich bought a single year of peace for Europe—and at year's end the British and French were worse off in confronting the Germans than at the beginning.

Dr. Paul R. Schratz
Homosassa Springs, Florida

Armies of the World: 1854-1914 by David Woodward. New York: G. P. Putnam's Sons, 1979, 189 pages, $12.95.

Here David Woodward offers us a single, concise volume, consolidating information from dozens of sources on military dimensions of the pre-1914 world. He has attempted to survey the armies of Prussia/Germany, France, Russia, Austria-Hungary, Turkey, Italy, the United States, the United Kingdom, India, Japan, China, and Switzerland. Each chapter concludes with a short summary of technical details describing the army under consideration.

Unfortunately, Woodward's study is not a good one. Casual readers will be impressed by the remarkable photographs and lively narrative, but historians will be troubled by the author's uneasy command of factual information and his uneven interpretation of historical developments. Taking just the example of Austria-Hungary, admittedly a complicated but significant case, we find several disturbing passages. The author's brief discussion of the Revolutions of 1848 in Central Europe omits the deeds of Windisch-Graetz, Jellachich, and Radetzky, reflecting Woodward's failure to appreciate the army's central role in the Hapsburg monarchy. Furthermore, we are led to believe that the creation of the Dual Monarchy occurred in 1848-49, an error of some nineteen years and three wars. To blame the Hapsburg court for the 1866 loss at Sadowa, as Woodward does, without considering the effect of superior Prussian arms, is certainly an oversimplification. The author's assertion that Emperor Francis Joseph wanted above all "a quiet life and an army which merely looked well [*sic*] on parade" is hardly worthy of comment.

Woodward's apparent reliance on J. S. Lucas *(Austro-Hungarian Infantry, 1914-1918,* London, 1973) leads to considerable confusion concerning the significance and meaning of the term *kaiserlich-königlich* when applied to the Cisleithanian *Landwehr.* More seriously, to label the *Landwehr* and the Hungarian *Honved* as second-line troops on the eve of Austria-Hungary's last war is misleading at best. The author would have benefited by studying *The Army of Francis Joseph* by Gunther Rothenberg (Purdue, 1976).

A serious flaw in Woodward's book is lack of documentation and bibliography, a problem made only more telling by factual inaccuracies and questionable interpretations in the narrative. The author is a journalist by profession; his book is a work of journalism, not historical scholarship.

Captain Joe C. Dixon, USAF
Department of History
United States Air Force Academy

Airborne at War by Napier Crookenden. New York: Charles Scribner's Sons, 1978, 144 pages, $14.95.

On 31 March 1977, the 16th Parachute Brigade, Britain's last "airborne formation," ceased to exist. Similarly, the United States has cut back its airborne units until only the 82d, "America's Guard of Honor," remains. *Airborne at War* is a nostalgic challenge to these reductions by a veteran British paratrooper, General Napier Crookenden, retired.

In his *Drop Zone Normandy* (1970), Crookenden's purpose was to write a definitive campaign history. Here he seeks to determine ". . . what sort of spirit the Airborne assault developed in its soldiers . . ." He does this by covering four lesser known operations: the German jumps at Fort Eben Emael and Crete, the 1945 American assault on Corregidor, and the joint American/British bridging of the Rhine, Operation Varsity. Many excellent maps clarify operation objectives, but Crookenden's coverage of the events themselves is spotty. This is of little concern to the author, for, in keeping with his objective, he substitutes numerous accounts of personal bravery and hundreds of excellent photographs for battle details.

In the process, however, the author skirts larger issues. After Crete, Hitler sounded the swan song for future German airborne operations: "The days of the parachute troops are over. The parachute weapon depends on surprise and that now is gone." Was he right? Were the Corregidor and Rhine jumps necessary? The author summarily says they were—they saved lives—but he is unconvincing. Moreover, he fails to mention how the Allies resolved the traditional airborne problems of antitank defense and drop zone dispersion which are still potential concerns.

Despite these intentional shortcomings, *Airborne at War* does represent a powerful reminder to today's military. Every airborne operation during World War II was a potential disaster. The soldiers realized this, yet they jumped, and once on the ground they operated like uncaged tigers. They fought as they did because they were proud of trying to do the impossible—and sometimes succeeded.

A peacetime commander's greatest challenge is developing and maintaining this same attitude among his men. In a *New York Times* editorial in January 1979, General Matthew B. Ridgway, appealing the loss of the 82d Division's beret, said that esprit is a "delicate intangible, nurtured over long periods of time in many seemingly trivial ways." Today, the airborne forces are still jumping out of airplanes; they are still expecting more from their people, and they are still proud. The day of the large-scale airborne operation might be over, but its spirit that Crookenden describes so well must persist.

Major E. P. Semmens, USA
Department of History
United States Air Force Academy

The Anatomy of a Small War: The Soviet-Japanese Struggle for Changkufeng/Khasan, 1938 by Alvin D. Coox. Westport, Connecticut: Greenwood Press, 1977, 409 pages, $25.00.

The only redeeming feature of this otherwise tedious and boring book is that it is well documented. The readers who will want to take on this collection of minutiae are those who like to follow a minor battle minute by minute, bullet by bullet.

The publishers of *Anatomy* tout it as a comparison of ". . . factors involved in this short-lived struggle with similar aspects of the series of limited wars which occurred . . . since the conclusion of World War II." Professor Coox spends four and one-half pages making this comparison.

The other four hundred four and one-half pages are filled with minutiae about the Japanese version of the battle. Coox revels us with such facts as, "At 2:52 Itagaki left Tokyo . . ."; or, ". . . total ammunition expended: 7,291 rifle cartridges, 397 hand grenades, and 290 grenade discharger rounds." It was a struggle for me to get through page after page of such detail.

The comparisons drawn and any lessons to be learned from this skirmish do not need such detail. Coox's attempt to make some connection to relevance fails miserably. I suspect this book is the product of an author who loves research. It probably will be of interest only to those students of warfare hoping to find profound lessons in the detail of obscure battles.

Colonel Rodney *V.* Cox, Jr., USAF
Ramstein AB, Germany

Eisenhower Declassified by *V*irgil Pinkley with James F. Scheer. Old Tappan, New Jersey: Fleming H. Revell Co., 1979, 400 pages, $12.95.

The last decade has witnessed an increased interest in Dwight D. Eisenhower. While previous studies pictured him as a kindly yet befuddled father figure who felt more at ease on the golf course than in the Oval Office, recent research has found Ike to be far more astute in his thinking, far more in control of his administration, and far more subtle in his leadershio than earlier realized. The prosperity, peace, and near-zero inflation of his administrations no longer seem to be a simple case of Ike's good luck. A number of studies published during the past decade demonstrate various aspects of this newer, more positive interpretation.[1]

Pinkley's biography, although following this trend, seems oblivious to any of this recent research. Although he boasts of extensive bibliographic and archival work, his book belies the claim. Instead, the author appears to be trying to do for Eisenhower what Parson Weems did for George Washington. Other than an explosive temper that his mother helped cure during his childhood, Ike is pictured as a man totally without faults. In addition, this study is hobbled by a style that is consistently chatty, oversimplified, and superficial.

Along with these characteristics are the author's numerous errors. Allied troops on the Anzio beachhead were not systematically shelled by Germans entrenched on Monte Cassino, since the two points were separated by approximately sixty miles (p. 164); Communists seized control of Czechoslovakia in 1948, not Hungary (p. 261); and Truman initiated serious desegregation in the armed services, not Eisenhower (p. 356).

The book also presents some of the silliest writing I have seen. Pinkley, who served as a correspondent for United Press in North Africa and Europe during World War II, begins one chapter with the words, "Now it can be told!" He then continues breathlessly to let us in on the secret that Eisenhower sometimes became exasperated when Churchill tried to interfere with military planning. Wow!

Let me stop here, for this work does not warrant a longer review. Let it simply be said that, despite its pretensions, this book cannot be taken as serious biography. It may, however, have a place in fifth to eighth grade libraries: With its see-Jane-run style—rarely does any paragraph have more than two or three sentences—it might stimulate enough interest for a student to study the real Dwight D. Eisenhower, a man who both as a person and as a leader, I believe, stands as one of the great figures of this century. Surely Ike neither needs nor deserves such infantile works as Pinkley's.

Dr. Calvin L. Christman
Cedar Valley College
Lancaster, Texas

Note

1. Richard A. Aliano, *American Defense Policy from Eisenhower to Kennedy: The Politics of Changing Military Requirements, 1957-1961* (Athens: University Press of Ohio, 1975); Douglas Kinnard, *President Eisenhower and Strategy Management: A Study in Defense Politics* (Lexington: University Press of Kentucky, 1977); Herbert S. Parmet, *Eisenhower and the American Crusades* (New York: Macmillan, 1972); Peter Lyon, *Eisenhower: Portrait of the Hero* (Boston: Little, Brown & Company, 1974); Charles C. Alexander, *Holding the Line: The Eisenhower Era, 1952-1961* (Bloomington: Indiana University Press, 1975); Elmo Richardson, *The Presidency of Dwight D. Eisenhower* (Lawrence: The Regents Press of Kansas, 1979); Lester H. Brune, "The Eisenhower Administration and Defense Policy," *Armed Forces and Society*, Spring 1980; Vincent DeSantis, "Eisenhower Revisionism," *Review of Politics*, April 1976; Fred I. Greenstein, "Eisenhower as an Active President: A Look at New Evidence," *Political Science Quarterly*, Winter 1979-1980; George H. Quester, "Was Eisenhower a Genius?" *International Security*, Fall 1979; Gary W. Reichard, "Eisenhower as President: The Changing *V*iew," *South Atlantic Quarterly*, Summer 1978.

The United States and Micronesia in Free Association—A Chance to Do Better? by Philip W. Manhard. National Security Affairs Monograph Series 79-4, 1979, 77 pages, no cost given.

"Give a man a fish and he will ask for more; teach a man how to fish and he will feed himself." The significance of this old Micronesian maxim is at the core of Ambassador Philip Manhard's monograph, which offers some suggestions for future relations between the United States and the Trust Territory of Micronesia.

Manhard traces the relationship between Goliath, the United States, and David, Micronesia, from the establishment of the trust in 1947 to the present day. He points out the problems facing us as we attempt to chart a future course for a group of more than 2000 islands with a total land area of about 700 square miles and a population of approximately 120,000.

One of the more serious problems has been the substitution of welfare for development—thus vitiating the Micronesian will to progress or develop independently. Nonetheless, Manhard stresses that progress and development are essential. He proposes a scheme of free association with direct White House monitoring. The author, whose diplomatic career has been centered in the Pacific, is eminently well qualified to discourse on this particular subject, and his paper, casting stones and laurels equally at both sides, is one of the most level-headed approaches to the problem of Micronesia to be seen in a long time.

Major Charles Ray, USA
Special Operations Division, C3
Seoul, Korea

The Dauntless Dive Bomber of World War II by Barrett Tillman. Annapolis, Maryland: Naval Institute Press, 1976, 248 pages, $14.95.

Barrett Tillman became interested in the Dauntless aircraft while rebuilding an A-24B Banshee (the Army/Air Force version of the Navy/Marine Corps SBD-Dauntless). Spurred on by his father, a former Marine Corps SBD pilot, Tillman produced this well-written and entertaining account of the Dauntless in World War II. The "flavor of the times" has been captured by the author's careful blending of individual aviator accounts with official and secondary sources.

Although dive bombers accounted for over 70 percent of the hits made by both sides during the four great carrier battles in 1942, the Dauntless "remains largely unheralded and perhaps even unappreciated, despite the absolutely crucial role it played throughout the Pacific War." While it may be a fact of life that air-to-air combat will always receive the glory, it is up to the historian to point out that battles and wars are not won by the aces but by a team effort. The spearhead of the naval team in the Pacific was the Douglas SBD Dauntless. In 1942 alone, the SBD accounted for over 300,000 tons of enemy shipping sunk, including six carriers, one battleship, three cruisers, four destroyers, and four submarines. During the 1941 to 1945 period, approximately 80 Dauntless dive bombers were shot down by Japanese aircraft while accounting for 138 enemy confirmed kills. This account of the Dauntless in World War II is well worth reading.

Major Robert J. Scauzillo, USAF
Mountain Home AFB, Idaho

Leo Szilard: His Version of the Facts edited by Spencer R. Weart and Gertrud Weiss Szilard. Cambridge, Massachusetts: The MIT Press, 1978, 244 pages, $17.50.

In the publishing trade, this book belongs to the genre of "status" or "quality." It is one pound away from being a doorstopper. As cumbersome and pasted together as this collection is, however, the notes, tapes, and letters are often intriguing, personal, and filled with intelligence and warmth.

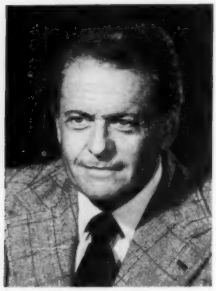
Szilard must have been a good friend and a wise counselor, for much of the material reads like a dialogue between trusting and concerned confidants. But fair warning: this book is for those thoroughly interested in the personality and mind of the scientist at work and in relationship with his peers. It is a clear statement of the way a scientist thinks.

Like any diary by an Einstein, a Conant, or a Fermi, it is an individual history, revealing and unedited. The reader will witness the development of nuclear bombs through a close and speculative point of view; and along the way will come to know, among a range of experiences, what it was like to try to help refugees escape nazism, and what it was like to survive the boiling point of two world wars.

At their best, these documents remind us of the value of intelligent and public-spirited people who seriously respect the workings of the brain and use its output to create, in the final analysis, "a more livable world."

Dr. Porter J. Crow
West Palm Beach, Florida

the contributors



The Honorable Cecil "Cec" Heftel (B.S., Arizona State University) was elected to the United States Congress in 1976, representing the First Congressional District of Hawaii. Congressman Heftel, a Democrat, serves on the Ways and Means Committee and on the Subcommittees of Health and Oversight. He served as a cryptographer with the Army Air Corps during World War II. Prior to his election to Congress, he had been in radio broadcasting for thirty years and active in community services.

Lieutenant Colonel Robert J. Jamsky, DC (B.A., Pennsylvania State University; D.D.S., Temple University) is assistant base dental surgeon, Grissom Air Force Base, Indiana. He has published an article in *Oral Surgery* and is a contributor to the textbook *Diseases of the Oral Mucosa*. Lieutenant Colonel Jamsky is a graduate of Air Command and Staff College and Industrial College of the Armed Forces.

Colonel John Schlight (B.A., Saint Vincent's College; M.A., Fordham University; M.A., Ph.D., Princeton University) is Chief, Special Histories Branch, Office of Air Force History, Bolling AFB, D.C. He previously served as director of academic affairs at the National War College and is a tenured professor of history at the United States Air Force Academy. Colonel Schlight is the author of two books, *Monarchs and Mercenaries* (1968) and *Henry II Plantagenet* (1973), and many studies on Southeast Asia.

Ambassador John Patrick Walsh (Ph.D., University of Chicago) before his retirement was the State Department Adviser to the Commander of Air University (ATC). As a foreign service officer, he served in a variety of assignments at home and abroad, including serving as the Ambassador to Kuwait. Ambassador Walsh was an International Fellow at Harvard University, and he has received the award for Exceptional Civilian Service from the Secretary of the Air Force. He is a previous contributor to the *Review*.

Lieutenant Colonel Joseph A. Breen (M.A., State University of New York) is an international politico-military affairs officer with the Joint Chiefs of Staff. He has served as a fighter pilot, high-altitude reconnaissance pilot, advisor to the Vietnamese Air Force, commander of a KC-135 squadron, as an attaché with the U.S. Embassy in Bangkok, and he was a research associate at the Mershon Center for National Security Policy Studies at Ohio State University. Colonel Breen is a graduate of Armed Forces Staff College and Industrial College of the Armed Forces.

Janusz S. Przemieniecki (Ph.D., University of London) is Dean of the School of Engineering and Senior Dean of the Air Force Institute of Technology. Before joining the AFIT faculty in 1961, he was a member of the design team for the Anglo-French supersonic transport, Concorde, and the Mach 3 fighter aircraft, type 188. Dr. Przemieniecki is the author of *Theory of Matrix Structural Analysis* and has published over forty papers in scientific and technical journals. He received the Air Force award for Exceptional Civilian Service in 1978.

Lieutenant Colonel Robert S. Fairweather, Jr., USA (USMA; M.S., University of Southern California) is TRADOC System Manager for Scout helicopters with the U.S. Army Aviation Center, Fort Rucker, Alabama. Colonel Fairweather, an Army aviator and field artilleryman, has published articles in *Army, Army Aviation Digest,* and other publications and is author of the helicopter chapter in *Modern Airmanship.* He is a graduate of the Air War College.

Lieutenant Colonel (GS) Jürgen B. Arbeiter is Chief of Staff, *Panzergrenadierbrigade 17* with the Federal Armed Forces, Federal Republic of Germany. He was Visiting Fellow at the Centre for International Relations, Queen's University at Kingston, Ontario, Canada, for 1979-80. Colonel Arbeiter is a graduate of the Command and General Staff College at Hamburg, the junior staff officer course in the British Army of the Rhine, the Federal Armed Forces Military College, and is a Distinguished Graduate of the United States Army Artillery and Missile School, Fort Sill, Oklahoma.

Captain Kenneth C. Stoehrmann (USAFA; M.A., Fletcher School of Law and Diplomacy, Tufts University) is an instructor, Political Science Department, USAF Academy. He served as an executive officer during a one-year Air Staff training tour at Hq USAF. He is a Distinguished Graduate of the Undergraduate Navigator Training School, Squadron Officer School, and the USAF Academy. Captain Stoehrmann is a previous award-winning contributor to the *Review.*

John J. Sbrega (B.A., Union College; M.A., Ph.D., Georgetown University) is Associate Professor of History and Department Head of Social Sciences at J. Sargeant Reynolds Community College, Richmond, Virginia. He was a Fulbright Scholar to the United Kingdom, 1972-73, a participant in the first State Department Scholar-Diplomat Seminar, and took part in the "Americans as Proconsuls" seminar of the American Committee on the History of the Second World War. Dr. Sbrega was a USAF pilot, flying medical evacuation and supply missions in Southeast Asia.

Captain James S. O'Rourke IV (B.B.A., Notre Dame; M.S., Temple University; M.A., University of New Mexico; Ph.D., Syracuse University) is Assistant Professor of English, United States Air Force Academy. He has served as a public information officer and station commander for the American Forces Radio and Television Service. Captain O'Rourke has published in *Journalism History* and is a previous contributor to the *Review.*

The Air University Review Awards Committee has selected "Alienation, Anomie, and Combat Effectiveness" by Major Daniel W. Jacobowitz, USAF, as the outstanding article in the September-October 1980 issue of *Air University Review.*

IRA C. EAKER ESSAY COMPETITION

AIR University takes pride in announcing the first Ira C. Eaker Essay Competition. This competition is open to all United States Air Force personnel: active duty, Reserve, and Air National Guard. Its purpose is to honor the continuing achievement of General Ira C. Eaker and to memorialize the indomitable martial spirit of General Eaker and his colleagues who lifted American military might from the surface of the Earth into the third dimension of aerospace.

Essays should address problems of strategy, doctrine, leadership, or some combination thereof, within the overall context of military exploitation of the aerospace medium.

First, Second, and Third Prize Medallions will be awarded to the winners as well as U.S. Savings Bonds in the amounts of $2000, $1000, and $500. Honorable Mention recognition certificates will also be awarded.

The essay competition is funded by a permanent grant from the Arthur G. B. Metcalf Foundation, made through the United States Strategic Institute of Washington, D.C.

Essays in the competition should be 2000 to 4000 words and typewritten, double-spaced, on standard-size paper. The author's name and address should appear only on a cover-sheet title page. Address entries to The Editor, *Air University Review*, Building 1211, Maxwell AFB, Alabama, 36112. Entries for the first competition must be received or postmarked by 1 June 1981. Essays are submitted with the understanding that rights of first publication belong to *Air University Review*, the professional journal of the Air Force, to be released after the competition at the Editor's discretion.

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